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The New York State Public Service Commission, in refusing to grant a "certificate of public convenience" to promoters of the Buffalo, Rochester & Eastern Railway, to parallel the New York Central from Lake Erie to the Hudson river, has done a notable public service. The commission justifies its existence. The opinion, said to be a long one, is not yet made public, but the commission has issued a summary of its 19 findings or reasons for refusal. The first six of these findings pertain strictly to that function of the commission which is intended to conserve the interests of the investors in railway bonds and stocks. The commission thinks the road would not pay. The findings numbered seven to ten are that the eastern connections, supposedly the Boston & Maine, have insufficient facilities for taking care of additional traffic. Findings 11 and 12 indicate that the western lake and rail connections do not have a capacity for supplying more traffic than the existing New York lines are capable of handling. Findings 13 to 15 are that the new proposition does not offer cheaper transportation, offers only slight additional facilities for local business and is not so located as to appreciably increase traffic. Findings 16 to 18 consist of a rather emphatic endorsement of the New York Central's representation as to the quality and quantity of its existing facilities, tracks and terminals and their present and prospective increases. Finding No. 19, to the effect that the financial ability of the applicant, the Buffalo, Rochester & Eastern, is inadequate, is final and suggestive: "There are more than a dozen reasons why I don't want that horse of yours; in the first place, I haven't any money." "You needn't bother about giving the other dozen reasons; they don't interest me," said the seller.

"Resolved, That this Association appreciates the educational value of the exhibition of railway appliances at the Coliseum, and the high standard upon which the exhibition was organized and conducted."

This formal expression, made in the closing session of the tenth annual convention of the American Railway Engineering and Maintenance of Way Association, was deserved and sums up the value to railway officers, especially those in the engineering departments, of the splendid exhibition made by the Road and Track Supply Association in the Coliseum, Chicago, last week. From a few small tables of models crowded into a compact mass in the Auditorium Hotel, this annual display of railway appliances suddenly blossomed into a world's fair of track and signal appliances, covering more than 35,000 square feet, excluding the aisles. The doubt about the probable attendance of members of the American Railway Engineering and Maintenance of Way Association was dispelled on the opening day. And the visitors were not confined to the members and guests of that association. Presidents and railway officers from every department, and from nearby and distant points, took advantage of the invitations sent them to visit the Coliseum. The exhibition was successful from every standpoint and is destined to be a permanent feature and an addition to the splendid work of this important association. We again express the hope that a way may be found to hold the meetings and the exhibition under one roof.

A STUDY OF RAILWAY "MONOPOLY."

The annual report for 1908 of the Railway Commission of Massachusetts just come to hand contains two groups of figures which happen this year to be of exceptional interest though unlikely to attract instant attention. They are the two tables which show the average rate per ton-mile for freight and the average passenger fare per mile on the three prominent railway systems of New England—the Boston & Albany, the Boston & Maine, and the New York, New Haven & Hartford. The special significance this year rests on the fact that ere long the last two systems will probably be united in form as they are already, in many respects, united in fact. Opposition to the control of the Boston & Maine by the New Haven's large purchase of shares undoubtedly continues in Massachusetts. But it is evidently waning, if for no other reason because of that "tired feeling" which affects both parties to a contest long drawn out. The event of merging the two systems will come very likely within a few months, and when it comes there will be an end of any comparison in the state railway commission reports of figures for freights and fares on the two roads. An interesting railway situation in New England will end, albeit a still more interesting one will be ushered in.

During the last few years we have referred a number of times to a territorial status of the railways of New England which make that region of six small but highly populated states unique. But the situation may be briefly restated. In the south is well nigh complete railway monopoly represented by the New Haven system intensified and conserved by boat line and trolley ownership. In northern New England is the Boston & Maine without boat line ownership, holding but a single trolley line and its territorial occupancy somewhat less than that of the New Haven. It stands for qualified monopoly. Between lies the Boston & Albany, which is no monopoly at all. We have thus in New England, in an intensive railway traffic region, monopoly, qualified monopoly and non-monopoly so closely related that

they may be studied on the same screen; and the best test of their threefold outworking in the direction of public necessity and convenience is, undoubtedly, the variation *downward* of freight rates and passenger fares through a considerable period of time. In a campaign of the kind there are, undoubtedly, some elements that cannot be computed. There have been readjustments of rates as new lines have been absorbed, new freight classifications and—in the case of passengers—uncertain coefficients represented, for example, by commutation and excursion business. But some of these elements are constants or nearly so, others tend to offset each other and they leave a residuum for comparison at once suggestive and fair after one or two of the more important variables have been pointed out and allowed for. The tables for three decades and the year 1908 follow:

	Average freight rate per ton-mile.				Average passenger fare per mile.			
Railways.	1880. cts.	1890. cts.	1900. cts.	1908. cts.	1880. cts.	1890. cts.	1900. cts.	1908. cts.
Boston & Albany...	1.21	1.11	0.82	0.87	2.09	1.86	1.75	1.77
Boston & Maine....	2.56	1.76	1.44	1.04	2.14	1.83	1.73	1.71
N. Y., N. H. & Hart.	2.41	2.07	1.45	1.42	1.92	1.73	1.78	1.59

In the Boston & Albany return for freight rate the absolutely low rate due to its large volume of low class through freight from the west must be noticed as well as the drop in the last entry of the Boston & Maine rate due to absorption several years ago (1901) of the Fitchburg line, a "through" line toward the west which before its absorption was carrying freight at the low rate of eight-tenths of a cent per ton-mile. Its merger in 1901 dropped the general freight rate of the Boston & Maine from 1.44 cents to 1.13 cents, a difference of 0.31 cents, which would imply say 1.35 cents in 1908 instead of 1.04 cents, the actual return. It seems fair to let such a change stand. Reduced to percentages the variation downward for 28 years becomes then for the Boston & Albany 28.1 per cent.; for the Boston & Maine 47.3 per cent. and for the New Haven 41.1 per cent. For passengers the corresponding figures are: Boston & Albany, 15.3 per cent.; Boston & Maine, 20.1 per cent., and New Haven, 17.2 per cent. The New Haven "monopoly" thus stands midway in passenger fares between qualified monopoly and non-monopoly, and far ahead of the latter in reduction of freight rates; and would, very likely, be ahead of the Boston & Maine in passenger fares reduced if the recent reduction to two cents a mile on its whole system were fully in the computation. Its absolute low passenger rate far below both monopoly and qualified monopoly will also be noticed.

But a fairer test is a comparison of the year 1908 with 1896, when, by its control of the New York & New England lines, the New Haven all but rounded out its railway monopoly of the southern New England region. For average freight rate per ton-mile the figures are:

	1896.	1908.
Boston & Albany	0.94 cts.	0.87 cts.
Boston & Maine	1.53 "	1.04 "
N. Y., N. H. & Hartford	1.57 "	1.42 "

While in average passenger fare per mile the following is the comparison:

	1896.	1908.
Boston & Albany	1.75 cts.	1.77 cts.
Boston & Maine	1.79 "	1.71 "
N. Y., N. H. & Hartford	1.76 "	1.59 "

Stated in percentages the freight rate variation downwards is for the Boston & Albany 7.4 per cent.; Boston & Maine 11.8 per cent., allowing for the Fitchburg merger; and for the New Haven 9.6 per cent. Corresponding figures for the passenger fares are Boston & Albany 1.1 per cent. *increase;* Boston & Maine 4.5 per cent. decrease, and New Haven 9.7 per cent. decrease, which would probably be considerably more with just allowance for the New Haven's two cents a mile reduction, while the much lower New Haven absolute rate is still conspicuous.

It is to be noted also that in New England we have the spectacle of a monopoly which has reduced rates voluntarily, both freight and passenger; and the passenger reductions were made against the filed protests of both qualified monopoly and non-monopoly; and we may add in passing that both were later compelled to lower rates themselves.

In a broad generality based upon the foregoing returns, perhaps the last of the kind that will be available in New England we see that railway monopoly, measured by the test of public service as expressed in reduction of rates, comes out somewhat ahead of qualified monopoly and a good deal ahead of non-monopoly. Were quality of public service and maintenance of plant considered, "monopoly" represented by the New Haven would undoubtedly be still further in advance. It is the more striking as the New Haven has had all but dominant influence over legislation in Connecticut and Rhode Island, and has developed along the lines of its elastic Connecticut charter. Consolidation followed by more efficient operation together with the potency of "monopoly" as a form of popular outcry are probably the prime factors in official returns which can hardly be reckoned harbingers of woe—in a local New England sense—when the New Haven, in full control of the Boston & Maine, acquires the railway overlordship of six states. What that domination may mean for railway systems outside of New England is another matter.

ELECTRIFICATION OF RAILWAY SYSTEMS.

The meeting of the New York Railroad Club for March was the annual electrical meeting and was marked by the increased moderation in the claims of the representatives of the new form of power. This tendency has been noted before, and it is a curious coincidence that as the electrical engineer's seat in the saddle becomes more secure, he becomes less insistently dominant in his claims for the all pervading reliability of the electric locomotive and motor. We do not hear nearly as much of the rapid disappearance and relegation to the scrap heap of the steam locomotive, as we did ten years ago, and, while there is no apparent diminution in the dream of complete electrification, it seems now to have been set back into the dim and indefinite future.

As usual on these evenings the speaking was done exclusively by the electrical engineers, and it appears, from a general resumé of what was said, that there is a pretty thorough disagreement among the doctors themselves as to the exact remedy to be given to the railway in order that its operation should be put upon the most economical basis of operation. There are strong advocates of each of the five systems that are in use: The low-tension direct-current; the high-tension direct-current; the single-phase; the three-phase, and the independent electro-gasolene or other motor. It is probable that each has its own peculiar field in which it can outclass any of its competitors, but with this reservation it seems to be pretty generally agreed that for long distance, heavy transmission railway work there must be a high voltage on the line; and, as one speaker put it, high voltage means 10,000 or more. Beyond this we are still in a state of uncertainty. With a fairly definite agreement as to what might be best for any specific case, we are far from being able to render a decision as to what course is best to pursue for a general scheme of electrification involving a wide extension. Probably it might almost be said at once that this would involve the use of the alternating-current in some form. In fact, the discussion referred to was marked by an absolute lack of any advocacy whatever for the low-tension direct-current system that is in use on the New York Central. It was absolutely ignored as far as trunk line or long distance work was concerned and the fight was waged between the advocates of the single-phase and three-phase systems; a conflict that involved some pretty flat contradictions and the development of some heat in the argument, with the direct-current men simply as on-lookers. The only speaker on this system contented himself with a brief resumé of the train delays that had been caused by the various elements of the system on the New York Central. These showed a high de-

gree of efficiency and were evidences of a satisfactory performance. Beyond this there were occasional references to the greater hauling power of the direct-current locomotives, weight for weight, as compared with the single-phase. Some vague attempts were made to explain this away on the ground that these direct-current locomotives were used only on very short runs, while the single-phase locomotives, running into the same terminal, were intended for a long haul. This, however, was an explanation that did not satisfactorily explain.

If it be conceded, as it seemed to be, that the alternating-current, in some form must be used for long distance work, then the dispute is narrowed to that between the advocates of the single-phase and the three-phase systems.

In the review of the struggle with the difficulties on the New Haven, that was published in the *Railroad Age Gazette* on January 1, it appears that the serious obstacles to regular operation have been pretty well cleared away, and the single-phase system may be regarded as having been proved efficient for the work. But, there still remains the light tractive power of the locomotives as compared with the three-phase which gives the latter an advantage, whereas a handicap is, at the same time, imposed by the necessity of limiting speed by the use of a constant speed motor.

Each side points to its own achievements as indicative of its future triumph. In this country the three-phase is about to receive its first application for heavy work in the electrification of the grades on the Great Northern. Abroad it has been used somewhat extensively though not exclusively. The two most notable instances are those of the Valtellina line in Italy and that of the Simplon tunnel. It will be recalled that the Simplon tunnel line was undertaken some time ago under a guarantee by the builders and has only recently been turned over to the Swiss government. In this the three-phase locomotives are worked with a voltage of 3,000 and develop, when running at the standard speed of 45 miles an hour, about 650 horse-power. This voltage (about 3,000) appears to be the maximum under which the three-phase locomotive can be worked and is a consequent disadvantage because of the necessity of using a step down transformer.

Over against the Simplon installation comes the recent decision of the Midi of France to use the single-phase for all of its developments, and this after a careful inspection of all of the installations of Europe. So, while confessedly there is a wide and even bitter difference of opinion among electrical engineers on the subject, and the final outcome is still uncertain, it looks as though the consensus of opinion was moving towards the single-phase as the final solution of the problem of long distance or trunk line electrification.

The matter of the cost of operating heavy traffic electric lines was not touched upon at all, in the meeting in question; probably because cost everywhere continues high. But, in a communication addressed to the Massachusetts Railroad Commission last October, Mr. Mellen, of the New Haven, stated that "we are not prepared to state there is any economy in the substitution of electrical traction for steam, but on the contrary we believe the expense to be very much greater." Still, this increase of expense was justified by a previous statement that "our electrical installation is a success from the standpoint of handling the business in question efficiently, and with reasonable satisfaction, and we believe we have arrived at a point where we can truthfully say that the interruptions to our service are no greater, nor more frequent at the present time than it was when steam was in use." This is merely a public utterance of what everybody suspects, but which no one, not even the operating officials, is, as yet, in a position to finally prove or disprove.

Among the details brought out at the New York discussion, not the least important was that of the greater efficiency of the electric locomotive as compared with the steam because of the necessity of losing so much time with the latter for cleaning and roundhouse work. It was estimated that the work could be done with 64 per cent. of the number of steam locomotives required, if electricity were to be used; and, in corroboration of this the mileage of the New Haven locomotives was cited. This was put at 210 miles a day. The use of the steel auxiliary running wire was given as an instance of a great improvement in construction, that had made all the difference between success and a partial failure on the New Haven.

Again, while high voltage transmission was granted as a necessity to economical operation, it was suggested that it would be best to use low voltage generators and then step up for transmission over the line.

Standards were touched upon by nearly every speaker, and were urged as of value to a limited extent. That is to say, it was thought that it would be well to standardize the location of the third rail, the height of the over-head wire, the number of cycles to be used with the alternating-current, and a few other matters that have really already worked themselves out into what is essentially standard practice. But, for the great mass of electrical and mechanical details, it is better to keep hands off for a time as the final outcome is still too indefinite as to details, and there is too much uncertainty as to what constitutes and will hereafter constitute the best practice.

It appears, therefore, that the electrical engineer feels quite sure that he is capable of solving any problem that may be presented, but does not yet feel sure that he has the best solution that can be obtained. He is no longer predicting the speedy demise of the steam locomotive, but feels sure that the end will come eventually. He looks upon the alternating high-tension current as the solution of long-distance traffic; thinks that the single-phase offers the greatest prospects of success, but recognizes that great improvements must be made in the motors so that weight can be reduced and hauling efficiency thereby increased so as to reduce what is now the excessive first cost of the locomotives required for the work.

THE DECISION IN THE MISSOURI RATE CASE.

The Missouri rate case tells simply the old, old story. An epidemic of anti-railway agitation swept over the country. It became the fashion to reduce freight and passenger rates. The members of the Missouri legislature hadn't the slightest idea of what profit, if any, the railways in that state were making. But most of them felt sure that, whatever the roads were making, it was too much. The rest reflected that rate laws were being passed in other states, and probably it would cost them votes for re-election to oppose such legislation in their state. So, without any inquiry into the conditions and properties to which they were to be applied, a maximum freight rate bill and a 2-cent fare bill, to make big slashes in railway earnings, were passed with a "whoop." Few thought, and few cared, either in the legislature or in the constituencies, whether this was fair to the owners of the railways. They said that Mr. Hill, Mr. Gould, the Messrs. Moore, and the handful of other gentlemen who are reputed to own the roads were rich and "could stand it"—which is what a footpad might reflect after relieving Mr. Hill or Mr. Gould of his watch. The railways, strangely enough, did not relish being thus hazed and robbed. They appealed to the federal court. The court made the investigation of the value, the expenses and the earnings of the roads that ought to have been made by experts before the legislature ever seriously considered the passage of the rate laws. The investigation showed that the rates fixed were entirely unremunerative; and there was nothing for the court to do but nullify them.

The result shows—similar results in similar cases had shown a score of times and will show again—that a policy of railway regulation that is shaped entirely by the prejudice and quackery of those who regard with suspicion all corporations; by the

malice of those who have been injured, or think they have been injured, by railways; by the demagoguery of office-seekers; by the covetousness of travelers and shippers; and by the combined ignorance of the public about railway matters, will, in the long run, be ineffectual except to burden the calendars and the time of the courts, to increase the difficulty of bringing about proper relations between the carriers and the public, to hinder the development of transportation facilities, and to increase the probability of government ownership of railways, with its attendant incurable evils. The decision may, of course, be reversed by the Supreme Court of the United States. But that seems improbable. Repeatedly the Supreme Court has nullified state rate laws, because, having been passed without investigation or regard to fairness, they were found to be confiscatory. Every such decision is a warning to Congress, state legislatures, railway commissions and the public, that the regulattion of railways, in order to be constitutional and effective, must be intelligent and fair; and fair and intelligent regulating can be done only by unprejudiced bodies of experts, such as are to be found in not over a half-dozen states in the Union. It takes a long time to teach and learn a lesson so plain, and simple, and just.

Judge McPherson's decision probably means that practically all the freight and passenger rate legislation passed in the West in the past two and a half years will be set aside. But it does not establish any new principles. Counsel for the railways argued very persuasively that the Missouri laws were unconstitutional, not only because they were confiscatory, but also because they interfered with interstate commerce. The case was a good one in which to urge this point. Owing to the presence of such basing points as St. Louis and Hannibal on the Mississippi river, the state's eastern boundary, and Kansas City and St. Joseph on the Missouri river, its western boundary, and the competitive relations between the lines serving these cities, and also between these lines and the lines serving the cities on the eastern and western boundaries of Iowa, the state rates in Missouri, whether fixed by the railways, the legislature or the state commission, absolutely determine the interstate rates on commodities moving in, out of and through Missouri and the states north and south of it. But Judge McPherson refused to hold that rates fixed by state authority which would pull down interstate rates interfered unconstitutionally with interstate commerce. "The sole theory," he said, "on which rates are adjudged void can only be that the rates are not compensatory." There are many good lawyers who think that the Supreme Court of the United States will hold differently if a case is ever presented to it attacking rates made by state authority solely on the ground that they interfere with interstate commerce. It said in its decision in the Minnesota rate case last year that "the question, at any rate, is not trivolous."

One of the most interesting and important parts of Judge McPherson's opinion is that in which he discusses and specifies the percentage of return on its value which he thinks a railway is constitutionally entitled to earn. He holds that a "railway property, properly built and properly managed, should, over and above expenses, make a return of 6 per cent. per annum," basing his ruling chiefly on the recent decision of the Supreme Court of the United States in the Consolidated Gas Company case. Is it a logical inference, from the ruling that the Consolidated Gas Company is entitled to 6 per cent., that this is all to which a railway in Missouri is entitled? Capital is scarcer, the demand for it stronger and the rate of interest higher in Missouri than in New York. The difference in conditions is recognized by the interest laws of the two states. The maximum rate of interest for which anyone may legally contract in New York is 6 per cent.; in Missouri, 8 per cent. If a public service corporation is entitled to a minimum of 6 per cent. in New York it would seem that a public service corporation in less developed parts of the country, where business conditions are less stable, should be entitled to the opportunity to earn more than that amount.

The court evidently meant that 6 per cent. is the minimum *average* annual return to which a railway may constitutionally be restricted by public authority. It may be allowed, from motives of public policy, to earn more; but it cannot constitutionally be limited to less. A railway is quite a different kind of concern from a gas company. A railway's earnings fluctuate much more violently in transitions from good to bad, and from bad to good times, than a gas company's; and if a railway is entitled to an *average* of 6 or 8 per cent. per annum, it is obvious that it must be allowed to earn more than that much in the fat years in order to average that much in both the fat and the lean years—unless, indeed, the states and nation are prepared to make good its deficits in bad times from the public purse.

There is another important difference between steam railways and municipal public service corporations such as the Consolidated Gas Company. A water, or gas, or light, or telephone, or traction company in a city usually has a partial or complete monopoly of its business. But every steam railway meets competition at many points; and the lowest rate on any line between any points, whether made by its own management or by public authority, is the highest rate than any other road can get between those points. Now, if it be judicially established that *every* railway is entitled to earn at least 6 per cent. per annum on its value; and any one or more of a number of competing roads cannot earn that much on the basis of existing rates; does it not follow that all the competing roads are legally entitled to raise their rates until the weakest can make 6 per cent. even though the stronger lines be thereby enabled to earn more—perhaps much more—than 6 per cent.?

While Judge McPherson held the laws in question unconstitutional, he also, on the same evidence, expressed the view that a 3-cent passenger rate on the weak lines and a 2½-cent rate on the strong lines would be reasonable and fair. The very data that Judge McPherson cites in his opinion shows that on all of the weak lines and on many of the strong ones a 2½-cent fare would be insufficient to yield the 6 per cent. return to which he held that a railway is entitled. Nevertheless, there was at first a strong sentiment among the officers of the Missouri lines in favor of readjustment of passenger fares on the basis that the court suggested. When, however, Governor Hadley and Attorney-General Major, instead of indicating a willingness to negotiate with a view to reaching some basis of compromise, issued statements that they would carry the case to the highest court, the railway men who had favored a 2½-cent rate decided that the position of the roads in the ensuing fight would be strengthened by the restoration of the 3-cent rate everywhere. This outcome will be mainly due to the uncompromising attitude of the state, and we have no doubt that if the roads were officially assured that the establishment by them of a 2½-cent rate on the main lines of travel would end the litigation and create a more favorable public sentiment toward them, the lower rate would promptly be adopted.

Letters to the Editor.

BUSINESS-LIKE CO-OPERATION BY EMPLOYEES.

Owosso, Mich., March 15, 1909.

To the Editor of the Railroad Age Gazette:

I have read in the *Railroad Age Gazette* of February 26 the very interesting article on the matter of Railroad Brotherhood and Discipline, of which Mr. Cairncross, a conductor of the Gulf, Colorado & Santa Fe, is author. The subject is one of great importance in the operation of trains, and one which should receive broad consideration from both brotherhood and railway officers.

Mr. Cairncross says that in his long experience with brother-

hoods he has never heard discussed in the lodge room the matter of remedies for accidents and protection to company property. It will interest your readers to know that union meetings are being held by employees of the Ann Arbor Railroad, once each month, for the purpose of discussing accidents, rules and other matters pertaining to the best interests of the company. I attach a copy of a circular letter issued to all employees, for the meeting held February 14, which will show the subjects discussed and give an idea of the feeling of interest and loyalty of the men.

At these meetings there are members of all departments: enginemen, trainmen, yardmen, section-men, despatchers, agents and operators. The meetings are conducted according to parliamentary usages. Each employee is given an opportunity to bring up any matter of interest for discussion, and proposals are placed in the hands of a committee for recommendations to the head of the department.

At the meeting February 14 the general superintendent, superintendent, superintendent of motive power, chief despatcher, traveling engineer and general shop foremen were also in attendance, and a letter from the vice-president and general manager to the general superintendent was read. I take the liberty of enclosing a copy of it. The kind expressions and encouragement in this letter made the meeting one of unusual interest, and the men manifested renewed enthusiasm. They were made to feel that their loyalty in this direction was appreciated. Only when loyalty is thus recognized can the best results be accomplished.

The interest manifested in these meetings is such that they are of material benefit to the service. Unquestionably the men are brought closer together; they reach a better understanding of the rules and discipline. They come closer to the officers and thus open up the secrets of minor irregularities, the correction of which prevents larger ones.

When employees thus show their loyalty they command the highest respect, and no officer should hesitate in extending his hand and making them feel that they are welcome. He should interest himself to make their positions as pleasant as conditions will permit. When the men realize that he does that, the best results must follow.

Transportation officers and subordinates should also bear in mind that we are virtually in a mercantile business and must not lose sight of our obligations to the public. We manufacture transportation; our traffic departments are our salesmen; if we do not place a good quality of transportation on the market our salesmen cannot dispose of it. Under these conditions we should strive to make our goods the highest standard; be courteous to our patrons; make our deliveries promptly and in good order, and above all exercise eternal vigilance in delivering our cargoes of humanity to their destination in safety.

K. A. GOHRING,
Superintendent Ann Arbor Railroad Co.

[*Extract from Circular.*]

A union meeting of employees, representing the several departments of the service, will be held in Owosso on Sunday, February 14th, at 2 p. m., in the Engineers' Hall. One of the topics for discussion at this meeting will be: "In the interests of the company and the employees, how can we raise the standard of efficiency?" Employees unable to attend may send suggestions to H. O. Smith, Yard Master, Owosso. We request the co-operation of train despatchers, agents, operators and track foremen. . . . We ask the hearty co-operation of each department, one with the other. Each is a spoke in the wheel of progress, moving to a higher and better plane. This is a duty we owe to the company, the public, ourselves and our families.

(Signed) Geo. Pulcipher, B. of L. E.; A. T. Stotenbur, O. R. C.; Roy Bates, O. R. T.; L. Hayden, B. of R. T.; V. Almendinger, B. of L. F.

[*Extracts from Vice-President's Letter to General Superintendent.*]

. . . When you realize the antagonistic feeling that has existed, and does exist, between employers and employees on some roads, you can well feel proud of the invitation from the employees. It has the ring of loyalty. Loyalty covers a great number of short-comings. This letter shows that the employees are anxious and even hungry for a better feeling between the employer and the employee.

I have always been a believer in labor organizations, from the time I was a member myself, provided they are conservatively handled, and the railway labor organizations of to-day are handled by conservative and brainy men. There is no reason why the representatives of the railways should not extend their hands to the members of these organizations who are in their service, and work in unison with them, doing all they can for their comfort. We all know that railway life is hard at its best, and I know from experience that if these men that are laboring day and night for the success of the company, have the feeling that their work is appreciated by the officials over them, you can rest assured that they will respond and show their appreciation of it by good and efficient work.

Encourage meetings of this kind, and try to bring about closer relations. We are all employees, whatever may be the position we occupy, and we are all working for one common cause. The employer has no reason to feel himself above the men in the ranks. To make a perfect piece of machinery, there are a great many parts required; each part no matter how small has its own function to perform, and should receive due consideration.

GEO. K. LOWELL.

Contributed Papers.

RECIPROCAL DEMURRAGE.*

BY F. O. MELCHER,
General Manager, Chicago, Rock Island & Pacific.

The main objections to the bill itself, as such, may be outlined as follows:

1. We find in several different places, without systematic arrangement, instructions governing the placing, loading and forwarding of cars; being the initial steps in transportation process. Such an arrangement is confusing, incomplete and difficult of comprehension to the men who will be obliged to be instructed in this matter, in case this bill should become a law.

2. Section 3 requires the railway to deliver empty cars of the kind, size and capacity ordered, without the necessity of specifying the commodity to be forwarded. The bill should not contain this provision, but should simply require the railway to furnish cars for the commodities offered, and the railway should be advised of the nature and amount of the commodity, as well as be given full shipping instructions. The railway must not be restricted to the class of equipment which the shipper may desire for the movement of commodities; otherwise there will be an extravagant and uneconomical handling of equipment, and we cannot conserve the car supply, which is so necessary.

3. There should be some evidence of good faith in the ordering of cars for commodities to be forwarded. According to the terms of this bill, the railway could be required to furnish any number of cars, without any obligation on the part of the shipper to load the same. If such a bill is passed, it should contain a provision requiring a deposit of a portion or all of the freight charges by the person ordering the equipment, in order to prevent shippers from ordering cars, which they do not intend to load, for the purpose of securing to themselves the available equipment, to the detriment of some other person or interest.

4. There should be a provision which would make it clear that the railway will have a lien on the contents of the car in case the consignor or the consignee refuses to pay the demurrage charges accruing under the provisions of the bill.

5. If any restrictions are to be placed upon the time the railways will have to furnish cars, they should be reasonable restrictions that we can reasonably expect to observe. As an example: A greater time should be allowed to supply five cars than to supply one car, and the railways must, at all times, have sufficient time to supply special equipment that is not ordinarily available.

6. If restrictions governing the rate per day at which cars shall move after being loaded are incorporated they should relieve the roads from penalties in the event of emer-

*A memorandum submitted to the Railroad Committee of the Iowa Senate opposing the adoption of a reciprocal demurrage bill now pending before the Iowa Legislature.

gencies over which they have no control. There should be, in addition to the time permitted at junction and division points, further additional time allowed where carload or less-than-carload freight has ordinarily to be transferred.

7. Section 2 specifying the notice to be given to consignees, should provide additional time, or some arrangement to govern reconsigned freight, and should stipulate definitely when such notice may be considered as having been delivered.

8. Section 3 requires the railway to place loaded cars at accessible places for unloading, as directed by the consignee. This is objectionable, inasmuch as it may be impossible for the procedure indicated to be carried out. The opinions of the road's agent and the consignee may differ as to whether or not the place specified is accessible. The bill should not restrict the railway in the placing of its cars for unloading.

9. Section 3 provides additional free time, which is objectionable because it still further restricts the flexibility of the car supply as indicated before.

10. Section 4 allows additional free time for releasing cars of more than 60,000 lbs. capacity. This is extremely objectionable, inasmuch as it results in the same restriction of the car supply as indicated before.

The foregoing indicates, in some detail, the principal objections to the bill. The following *fundamental objections* to the passage of such bill should be considered, rather than any question of the efficiency of the various sections forming such bill:

The act under consideration purports to "prevent delays in the transportation and delivery by railways of freight." This object cannot be accomplished by legislation, and if the value of the bill is dependent upon accomplishing this purpose, then it is useless and a failure, and a burden on the commercial and transportation interests.

If the various bills passed by the states, individually, had any merit, the Rock Island Railroad would have discovered it before this. The Rock Island operates in fourteen states, and of these fourteen states nine have enacted so-called reciprocal demurrage laws. In these nine states you will not find any testimony by an intelligent person to show that laws of this character have prevented delays, or accelerated the movement of freight. You can readily imagine a road operating under fourteen sets of laws; what would be legal in one state would be illegal in another, although the conditions might be the same. A car moving from Chicago to Kansas City might find itself violating one law in Illinois, and suddenly find itself restored to a legal status in Iowa, and again discover that it is costing the railway company money, in the shape of fines and penalties, in Missouri.

The provisions of these bills cannot apply to interstate commerce, and therefore must constitute a discrimination against interstate commerce, in that no penalty exists for failure to furnish cars for interstate business or to forward them at a certain rate per day when employed in such traffic. Railways that sought to avoid the penalties of such enactments could reasonably supply cars for local or state traffic, at a greater expense, making a lesser number of miles per day, and permit interstate shipments to remain at shipping and receiving points, awaiting disposition, in order to care for state traffic. This discrimination would be detrimental to transportation interests.

If the railways sought to avoid penalties, they would send their cars to states where the penalties are greatest, in order to be relieved of the burdens of those states, and thus discriminate in favor of one state, as against another, and disturb the equity of car distribution, which is so essential to transportation success.

Therefore, the principal trouble in bills of this character is that they are not uniform. Demurrage bills, if they are necessary, must be uniform for all states, and apply alike to all traffic. If there is no uniform system governing all states and all railways, there must be discrimination in favor of certain individuals or states, and thus the way is easily opened for a legalized system of rebating.

Such enactments must be flexible enough to accommodate the great pressure of unusual transportation demand, which at times occurs.

The so-called "car shortage" started the agitation that led up to the introduction of these bills, coupled, in some cases, with the selfish interests of some communities which sought to enforce advantages.

The passing of a law cannot stop a car shortage any more than it can stop an epidemic. Car shortages occur in times of extreme pressure on transportation facilities, caused by an abnormal and rapidly changing commercial condition. The remedy is in improved facilities. Terminal facilities are required of sufficient capacity to assemble the freight that can be transported over a line of railway. The merchant must improve his facilities and be able to release the cars promptly. If the railway is furnishing cars of 80,000 lbs. capacity, the merchant must be prepared to take care of these cars in the same time as he formerly took care of a car of but 40,000 lbs. capacity. Railways seek to increase the efficiency of their equipment by purchasing equipment of improved design. Take the case of drop bottom or hopper bottom coal cars, which are designed to discharge their loads by gravity. Instead of spending a day and $4 in unloading 40 tons of coal, it should be unloaded in five minutes at scarcely appreciable cost, if the merchant handling the coal provides the proper facilities for so doing. When the railways are furnishing the cars the merchants must furnish the facilities.

By restricting the use of cars as warehouses and places of storage is the only way we can get the benefit of our increased transportation equipment. The railway company needs no greater incentive to furnish cars, and to move them promptly, than that of enjoying the increased earnings resulting from such efficient operation.

To penalize a railway for failing *to do something does not remove the disability* that makes it *impossible* for the railway *to do that for which it has been penalized.*

Take into consideration, please, that the railways, in order to meet the demands in flush times, have spent millions of dollars, and now have on hand 300,000 idle cars. Can your bill make these cars produce earnings? Why in times of car plenty is it necessary to apply penalties and still further burden the railways, when such penalties cannot be effective or of assistance in times of car shortage?

The bill under consideration contemplates that the originating road can be called upon to furnish any number of cars for any place, regardless of destination, within a short day of twenty-four hours, or pay a dollar a day for each car for failure so to do. Is it fair that the originating road be penalized for failure to furnish cars to load off its own rails? Will this action increase our car supply? Will this relieve congestion? Will this tend to conserve the car supply of the country? If the railways stand the penalty the people will have to carry the burden in the shape of increased freight charges, because the losses of an unprofitable transportation business must be finally assumed by the community.

This bill, in the opinion of experts, opens the door for the greatest legalized system of rebating that ever existed. You can appreciate that very little collusion between large shippers and officers of railways would permit, for example, the large elevators to get an unfair advantage over the smaller ones, and would result in defeating the purpose of the laws of the national government that place the shippers on an equal basis with regard to rates and facilities. Do not pass a bill that will bring back the rebates.

The necessity for uniformity in these matters appears to be recognized by the appointment of a sub-committee of the Committee on Car Service and Demurrage of the National Association of Railroad Commissioners, to formulate a uniform code of demurrage rules. This committee consists of five men,

with Franklin K. Lane, of the Interstate Commerce Commission as chairman, and will be aided by the expert advice of some of the more prominent car service managers. This committee, I understand, is to meet at Washington on April 2, and we are advised that it desires co-operation on the part of practical railway men. In its preliminary report it very wisely states that the rules must be framed "with a view not to securing free storage time for shippers, but to securing the largest possible use of railway equipment as a means of transportation" (in the United States). I hope your committee will consider this report very carefully.

The report I speak of further states that "public interest requires . . . that freight carriers should serve all shippers alike, no matter in what state such shippers may be located, and no matter whether such shippers are engaged in state commerce or interstate commerce. There is no dividend interest, and any rule or arrangement which makes a conflict in interest will be compelled to yield."

In these closing sentences are contained the strongest arguments against the passage of this bill.

THE APPROACHING TRANSFER OF THE ELECTRIFICATION PROBLEM.*

BY WM. M'CLELLAN, PH.D.

It has been very interesting to watch the assaults of the electrical engineer on the transportation problem, and his gradual approach to the final task—the supplanting of the steam locomotive. The street railway problem was solved years ago; then came the heavier elevated and subway applications; finally a certain amount of steam road electrification became necessary. Perhaps the opportunity would not have presented itself yet, had it not been for legislation in response to public clamor for relief from smoke and accidents in tunnels.

The electrical man approached this last important undertaking with supreme confidence, based on his past successes, so that under the stress of enthusiasm there was considerable prophecy of quick and extraordinary results. All difficulties were not foreseen, however, and in the working out temporary setbacks were recorded. Nevertheless, enthusiasm supported by patience and energy prevailed to bring success. This success is not final—will not be for years—but the thing is done. Train service can be handled reliably and economically by electric power. Proof of this is close at hand in the magnificent successes of the New York Central and the New Haven installations, both of which are now operating with most satisfactory reliability, and so far as we can learn, with pleasing economy.

As a result, the electrification problem is practically ready to be transferred to the field of the railway engineer. Hereafter the question will never be "Can I?" but must be "Shall I?"

Of course, it is not to be understood that the electrical engineer may drop all conection with the work. He will be just as necessary as a mechanical engineer is at present. But if he is an electrical engineer and nothing more, his sole function will be the perfection of details and methods. The real problem will be solved by the men who have both a thorough knowledge of railroading and of the possibilities of electric traction. Such men can be derived from the two heretofore distinct electric and railway fields, and the process is started. For some time numerous electrical engineers have been acquiring an accurate and profound knowledge of railroading and vice versa.

One can conceive of conditions, which, if they had prevailed, would have called for nothing more than an extension of modern subway and elevated practice. But these conditions did not obtain in the work to be done. Through trains, and other traffic, requiring interchange of motive power demanded the development of large electric locomotives. This feature marked the departure from all previous experience and was looked upon as the only uncertain element. As a consequence much attention and study was put on the locomotive with most satisfactory results. In one great terminal electrification it was the only part of the work which was not an enlargement or further development in details of what had been more or less standard for some time in subway and elevated work.

The system used for heavy transportation work up to the beginning of steam railway electrification had been the 600-volt, direct-current third-rail system. This system has been used so extensively that it has become standard in many of its details and could be made wholly so in all essential purposes, if proper means were used. But study of the electrification problem showed that there were some disadvantages in this system which would prevent it answering all requirements. Men began to look to other systems which perhaps would be more advantageous. As a result of this study and development, the railway engineer in taking up this problem is confronted with no less than five different systems, any one of which would probably do the work reliably, and with more or less economy and would be financially practicable. These systems are:

(1) The 600-volt direct-current third-rail system.

(2) The 1,200-volt (or higher) direct-current third-rail, or trolley system.

(3) The high voltage alternating current single phase system.

(4) The high voltage alternating current three-phase system.

(5) Various gasoline electric cars, and gasoline car systems.

A careful study of all these systems from both the technical and the financial standpoints will show that each has its own advantages under certain particular conditions. Congestion of traffic, limitations of space, number and kinds of grade, physical characteristic of the country, danger to public, etc., all bring about this singularity of advantage. For this reason, it may be stated very positively that no electrical engineer who comes to the matter with an unbiased mind is willing to advocate any one system as the only system to be used. Even those men who have greatest faith in one system find themselves compelled to counsel the use of other systems when warranted by circumstances of a problem at hand. This difficulty of selection has been in evidence in every important decision that has been made. The last important decision of this sort was made after the elaborate installations of the New York Central and the New Haven roads were available for study in a practical way, but in addition a large number of special experiments were thought necessary, all of which proved that the decision was far from easy.

There are a number of engineers who suggest disposing of all difficulties by simply deciding each specific case, whether large or small, according to its own conditions. If it be a terminal, a tunnel, a heavy grade, or what not—simply put in the system which is best adapted at the time. This would seem to be a short-sighted policy, and only justified if other action is found impracticable. Electrification does start in spots, but it will not end with these, and the question of extension is likely to arise very quickly. We know now that electrification is not a luxury which will be used under favorable circumstances, but is a system of transportation which is gradually bound to do a large amount of work now done by steam.

The fact is, we are not electrifying terminals, tunnels, grades, etc., but must electrify whole systems, and this point should be kept in the mind in all decisions. Electrification means investment of millions, partly in direct outlay, partly by losses due to interruption during installation, and partly

*A paper read at the New York Railroad Club March 19.

due to amortization of apparatus. It is of the utmost importance therefore to get started right, even if the work is only for a very small portion of the whole road. There is no problem before engineers in the railway world to-day which requires more broad-minded attention and consideration than steam railway electrification.

It is natural that the point of getting started right should appeal most strongly to the directors and other officials of railways who must finally accept the responsibility for spending the large amount of money necessary. These men think of whole roads and even systems. They see clearly not only the disadvantages of getting started wrong, but also the great advantage of starting right. For example, the present standard gage in use to-day has as its chief advantage the fact that it is standard. All engineers wish that a view far enough into the future had been possible in the early days so as to show the great advantages of a wider gage. It is not sufficient therefore to show that various systems can be installed more or less satisfactorily. The whole matter will be counted as experimental by broad-minded men, and will not command real backing on its merits until there is a practical unanimity among technical men as to what simple or composite system is generally applicable to all work.

A composite system would be undesirable, but it may be necessary. At one time the combination of apparatus for both direct and alternating current on one locomotive seemed formidable, but only a few days ago the speaker made several trips on a New Haven locomotive where this is done, and the change from one power to the other was simplicity itself—a push of a button or two on the controller. Nevertheless, it is probable that it is a case of simplicity being a result of careful design and eternal vigilance in operation.

Assuming, therefore, that it is desirable to settle at the earliest possible date just what electrical system will be most suitable for steam railway electrification in general, it becomes necessary to determine what conditions such a system must satisfy in order to be acceptable, and then to attempt to find means by which the adoption of this system may be secured.

It is evident, first of all, that if trunk line electrification is ever to be accomplished *it will be done by means of a high voltage system. By this we mean a voltage of ten thousand or more.* Arguments on this point have been presented, so that it is useless to introduce them here. It may be stated, however, that this conclusion is based chiefly on cost. We are considering, of course, freight and passenger traffic, local and through service, branch and main lines; in other words, a whole system. It does not take a great deal of consideration to show how difficult it would be to handle the whole traffic of the Pennsylvania Railroad between New York and Pittsburgh with anything but a high voltage system.

The necessity for high voltage will be all the more obvious when it is recognized that a fundamental requirement for complete electrification will be the ability to transmit enormous amounts of power to shifting locations, dependent upon accidental congestions of traffic. There may be times when a large part of the total generating capacity may be required at a place for a short time only. It is idle to lay out the transmission or contact system for any predetermined train service. The railway engineer can now mass his motive power to suit his convenience, and he will not be satisfied with less under electrification. It should be a fundamental maxim that no feature of electrification design should hamper or restrict railway operation proper.

Secondly, the system must be adaptable to all sorts of conditions. High voltage requires a certain amount of space, and perhaps would not be available in places where the space was insufficient, such as tunnels, subways, etc. Moreover, as years go on railway trains, particularly local ones, will undoubtedly run more into the streets of cities, above or below them, instead of stopping at terminal stations. It will probably be a long time before permission could be obtained or 11,000 volts could be used safely in the streets of a city. Therefore, if the same equipment is to be used, it will be necessary to have a lower voltage. This, of course, can be most easily and effectively done by means of alternating current, though the present working of the New Haven system in the Grand Central terminal shows that it is possible with direct current. The simplicity of the control apparatus, however, with the alternating system would make it more attractive than the use of both kinds of current. Moreover, in a long system there might be various tunnels, bridges and towns where the voltage would have to be lowered for a short distance and where the installation of direct current for that particular small portion of the road might be very expensive.

The simplicity of the alternating current system under these circumstances is obvious, when it is remembered how easily high tension taps could be placed on the auto transformer for varying trolley voltages. No changes would be necessary in low tension taps and group switches. The various sections of the line would be separated by section breaks of necessity. An automatic device could easily be arranged by which the transformer would always be set for the highest line voltage whenever a section break was struck, after which the motorman could throw in the proper tap which also could be easily protected from a mistake on his part.

An overhead trolley necessarily follows if a high voltage system is used, and, as noted above, a third rail or overhead trolley with direct or alternating current for low voltage where necessary.

We shall say nothing about cost here, because it is assumed that any system otherwise available will stand the financial test both in first cost and in operation.

The early standardization of details of electrification is almost equally important with the adoption of a general system. It must be acknowledged, however, that great care must be exercised in attempting anything along this line. If we standardize too soon we run the serious risk of adopting inferior methods and faulty design. We also may commit the greater error of stifling progress for a time and restricting the normal development of the art. On the other hand, we have too many examples of methods and arrangements adapted carelessly at the beginning of an art through inattention allowed to grow into standards. We suddenly find a much-to-be-desired change practically impossible.

To avoid this the whole matter should be placed in the hands of committees of the great national societies, just as all other matters requiring standardization. We have too many fine examples of proper action by these committees to need any discussion as to how conservative they should be. No one need fear that a committee from the American Institute of Electrical Engineers acting jointly with committees from the Master Mechanics' and Maintenance of Way associations would give hasty or insufficiently considered decisions.

It will now be well to note those parts of electrification which are most fundamental and therefore most in need of standardization. By fundamental we mean those features which would involve great interruption of service and enormous expense if they had to be changed later, and also all features which are involved in the interchange of equipment by different divisions or roads. Some of the features mentioned have become almost standard by usage.

(1) Location and type of third rail and shoe.
(2) Location of overhead contact conductor.
(3) Side and top clearances.
(4) Location of end couplings.

This includes sockets for lighting and heating bus, power bus and train line. Hose couplings have standard location now.

(5) Low voltage for direct and alternating current on third rail and overhead contact line.
(6) High voltage for overhead contact line.
(7) Frequency of alternating current.

EXPERIMENTAL VERIFICATION OF ARCH FORMULAS.

BY MALVERD A. HOWE.

Formulas based upon the elastic theory have been universally accepted as applicable to solid arch ribs composed of iron or steel, and, by those familiar with the theory and the behavior of materials under stress, the formulas have been accepted as applicable to stone and concrete arches.

The only attempt to verify by experiment, on a large scale, the accuracy of the formulas, was made some fifteen years ago by the Austrian Society of Engineers and Architects. The results were published in 1895, in 131 folio pages and 27 plates. The verification consisted in the comparison of the computed and measured movements of various points upon the arches under various loadings and then in loading the arches until failure took place. The results were quite satisfactory in all cases.

The object of the experiments described below was to verify

Fig. 2—Plumb Line and Microscope Used in Adjustment of Arch.

the results obtained from using the writer's summation formulas for the fixed arch as applied to ribs of reinforced concrete. These formulas are for the determination of H the horizontal thrust, M the bending moment at the support, and V the vertical reaction at the support. (In the experiments only vertical loads were considered. The formulas can be used for any loading.)

As a direct verification of the formulas was desired, it was decided to actually weigh the values of H, M and V at one end of a fixed arch.

The problem to be solved, then, consisted of building an arch with one end absolutely fixed and the other so arranged that at all times three conditions should be satisfied under all loadings. The three conditions being: (a) the span to remain unchanged in length, (b) the elevation of the support to remain constant, and (c) the tangent to the arch axis at the support to have a constant direction.

In order to actually weigh H, M and V, one end of the arch, evidently, had to be supported free of the usual abutment. To do this and satisfy the three conditions stated above seemed almost impossible, in fact the writer was told that it could not be done, yet it was done and the results obtained are *very satisfactory* when the difficulties encountered are considered.

The arch rib constructed for these experiments was of reinforced concrete. The axis was segmental with a span of 20 ft. and a rise of 2 ft. The depth at the crown was 8 in. and at the abutments 16 in. The reinforcement consisted of eight ¼-in. old style Johnson bars, four being 1¼ in. from the introdos and four 1¼ in. from the extrados. The rib was 12 in. wide throughout.

The concrete was composed of one part of Alpha Portland cement and four parts of bank gravel. About 10 per cent. of the gravel remained on a No. 1 sieve and about 50 per cent. passed a No. 8 sieve (eight meshes to the inch).

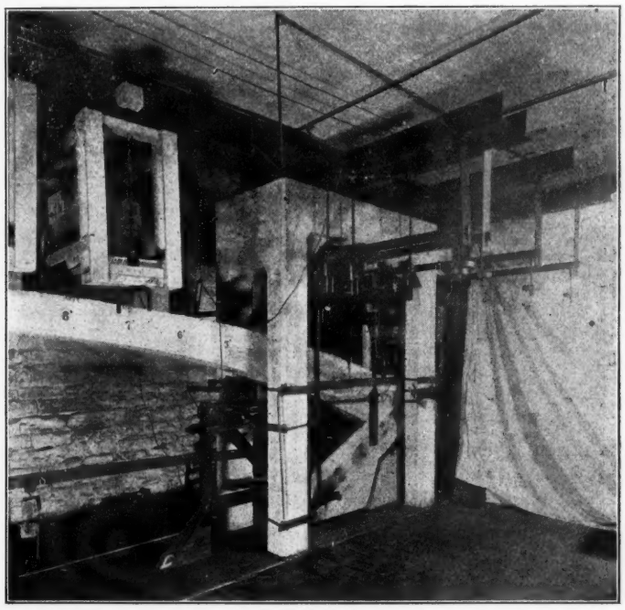


Fig. 3—Weighing Apparatus South End of Arch.

The weighing levers are seen at the right, suspended from beams. The first is No. 4, the next No. 3, and so on.

The concrete was mixed to the consistency of thick cream and the entire rib cast in a continuous operation.

The arch, its abutments and all weighing apparatus were supported on a concrete T beam composed of one part of Wabash Portland cement and six parts of bank gravel.

The arch was located in a transept, in the civil engineering laboratory of the Rose Polytechnic Institute, between two heavy stone walls running north and south. The north end of the arch was fixed by heavily reinforcing the concrete abutment and by eight ⅞-in. rods securely anchored in the masonry walls mentioned above. A steel pin $1\frac{7}{16}$ in. in diameter marks the end of the span. In order to check the immovability of this abutment one end of this pin was provided with "cross wires" on an enameled surface and by means of a powerful microscope, supported from the T-beam foundation, the end of this pin was found to be fixed under all conditions of loading.

At the south end (see Figure 3) a $1\frac{7}{16}$-in. steel pin was placed in a similar position between the arch and the mass

of concrete used for attaching the weighing apparatus. This mass was called the "head," for lack of a better name. The "head" was heavily reinforced with steel and so shaped that the center of gravity was directly below the center of the steel pin.

The weighing apparatus was supported from a reinforced framework carried by the T-beam foundation. Four distinct weighing systems were constructed, three weighing vertical loads and one the horizontal thrust. The vertical systems were attached to the steel pins by loop eyes extending to equalizing bars. The horizontal weighing device contained a bell crank so counterweighed that it floated when there was no horizontal stress. All systems contained turnbuckles for adjustment.

The arch span was divided into 20 equal parts and the loads applied on platforms resting upon two adjacent points of division.

Suppose no external load on the arch, and let levers 1 and 3 be brought into action by the turnbuckles and also lever 4. The turnbuckles being turned enough to insure that the "head" hangs perfectly free of the abutment. The weighing levers may now be balanced and the weights recorded. Let any external load be placed upon the arch, then in order that the difference between the weights recorded and the new weights shall represent the true values for a fixed arch, it is necessary to bring the "head" back to its first position and also be sure that the span and elevation of the arch axis at this support are the same as before.

The angular position of the "head" was fixed by means of a plumb line suspended from an upright attached rigidly to the "head" (Fig. 2). The weight at the lower end of the line was about two-thirds submerged in oil. As low down as possible, and attached to the "head," was a microscope opposite the plumb line. By means of turnbuckles in systems 1 and 3, this line and the cross wires in the microscope were kept in the same relative positions and consequently the tangent to the axis at this end was also in a constant position. Manipulating the turnbuckles in systems 1 and 3 to keep the plumb line in its proper place, changes the relative weights of 1 and 3, and hence we can determine the moment produced by the added load. For example: For the empty arch, suppose lever 1 shows 1,025 lbs. and lever 3 shows 1,569 lbs. Let some load be applied and suppose lever 1 now shows 1,481 lbs. and lever 3, 2,046 lbs. 1,481 — 1,025 = 456 lbs. and 2,046 — 1,569 = 477. Then 456 + 477 = 933 lbs. = V, or the vertical reaction produced by the added load.

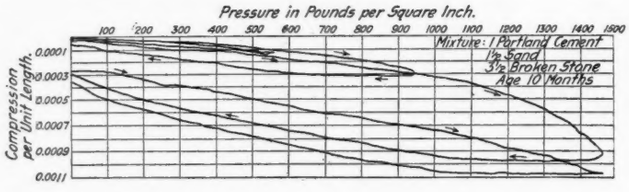


Fig. 4—Autographic Stress Strain Diagram Showing "Lag" —Concrete Block 6 in. x 6 in. x 9 in.

Since weighing systems 1 and 3 are each 2 ft. from the axis pin and 4 ft. apart,

(477 — 456)2 = (21)2 = 42 = M for the added load.

In other words, it requires a moment of 42 lbs. ft. to bring the "head" back to its first position.

That this moment produces tension in the upper fibers is evident since lever 3 has the greater weight. This corresponds to a negative moment. These results can be correct only when the span and the "elevation of the support" remain unchanged.

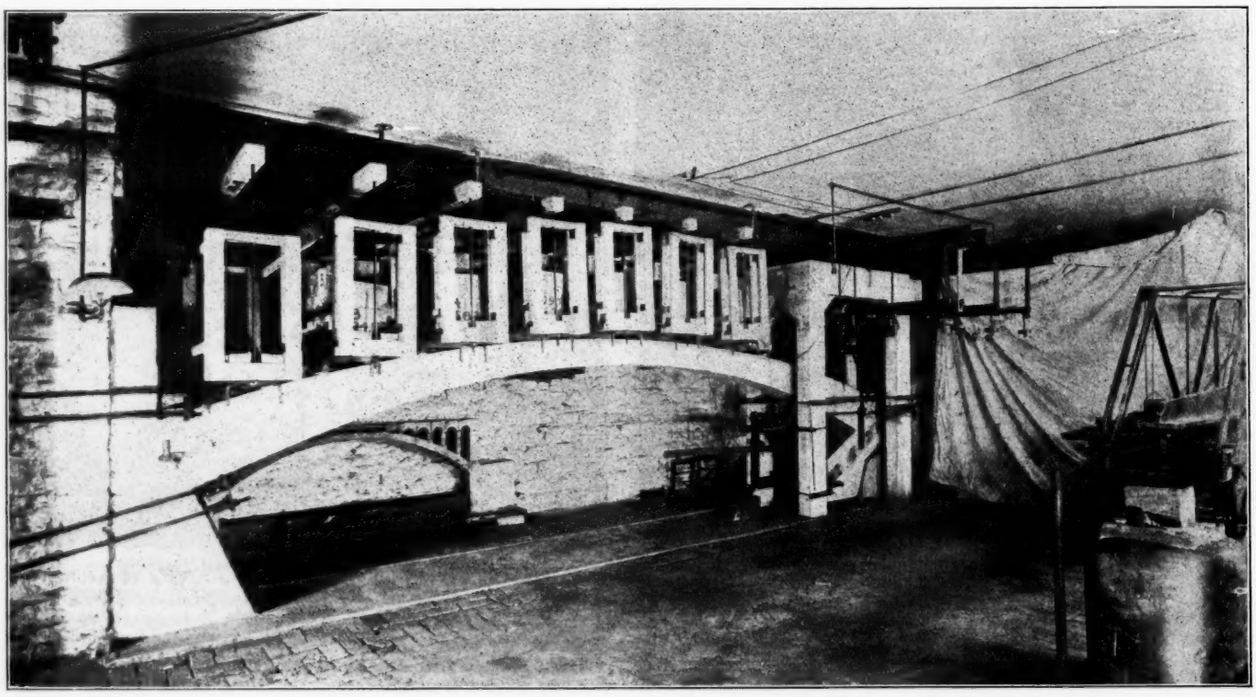


Fig. 5—Experimental Arch.

The elevation of the support and length of span was fixed by a microscope reading to $^1/_{10000}$ in., placed about opposite the south axis pin and carried by a steel bar clamped to the upright posts of the frame supporting the weighing devices (Figure 3). From the upper surface of the "head" an arm was brought, holding a glass with cross lines about opposite the center of the axis pin (Fig. 3). When the arch was empty the cross lines on the glass and the wires in the microscope were brought into some position readily recognized. When the additional load was added this position was maintained by manipulating the turnbuckles.

This adjustment and the plumb line adjustment were necessarily performed in conjunction, for both adjustments were

required in order to fulfill the requirements for a fixed arch.

As a very slight twist of the "head" would throw the microscopes out of focus, this was prevented by four roller bearings upon the two sides of the "head," the bearing against the head being that of a steel sphere, 1 in. in diameter (Figs. 2 and 3).

Two series of experiments were made, one in which the values of H, M and V were weighed for isolated loads on points 3 and 4, 5 and 6, 7 and 8, 9 and 10, 9′ and 10′ and 8′ and 7′

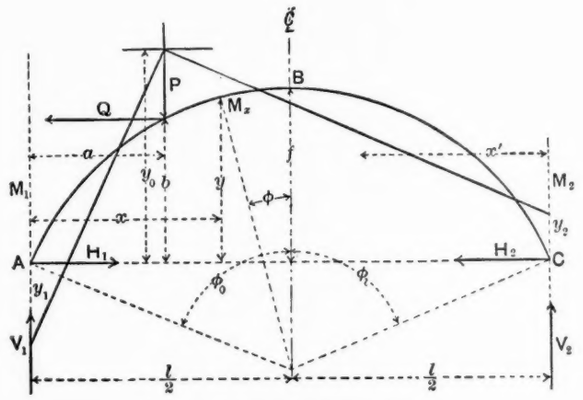


Fig. 6—Experimental Arch.

respectively, and the other for loads on points 3 to 4, 3—6, 3—8, etc.

In both cases the method of procedure was as follows: Arbitrary values of H, M and V were set on the weighing levers with the arch empty and the two microscopes adjusted to fix

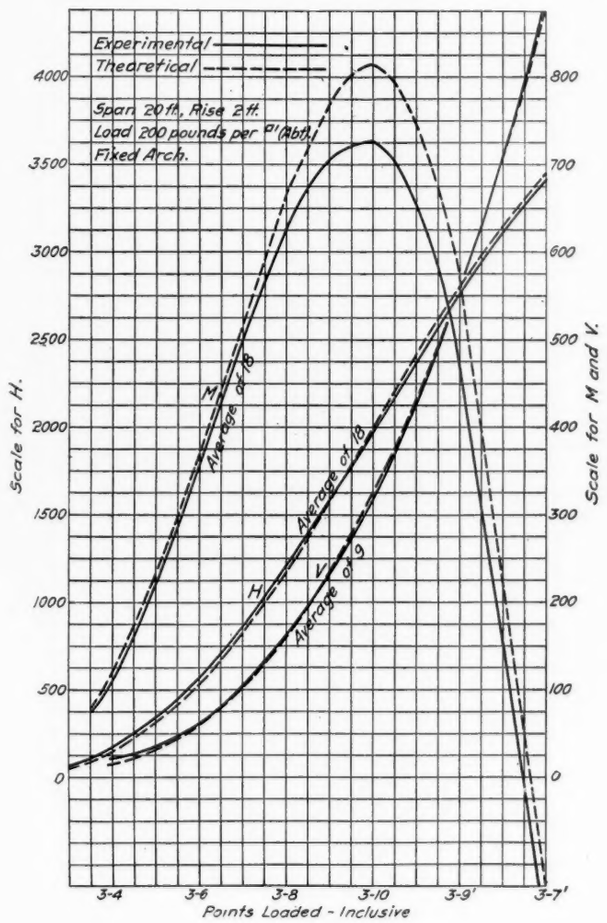


Fig. 7.

the span, elevation and tangent, also at the north end the microscope was set to detect any movement of the north pin. (This was used only occasionally, as no movement could be detected.) Then the loads were applied, and by means of the turnbuckles in weighing system 4, the span was brought to its original position. Next, by means of the turnbuckles in systems 1 and 3, the plumb line was brought back to its first position. Then the elevation was corrected. The last adjustments would usually change the span slightly and the same routine was followed again and again until all three adjustments were as nearly perfect as possible. It was found that *about right* would not answer, but that each adjustment had to be as nearly correct as it was possible to make it. Even after long practice the men assigned to the microscopes could not make two consecutive settings so nearly the same that a difference would not show upon the weighing levers. The weighing levers were sensitive to less than 5 lbs. under any loading used, which was more sensitive than the method employed for fixing the span, elevation and tangent. This was clearly shown by attempting to use a very sensitive level in

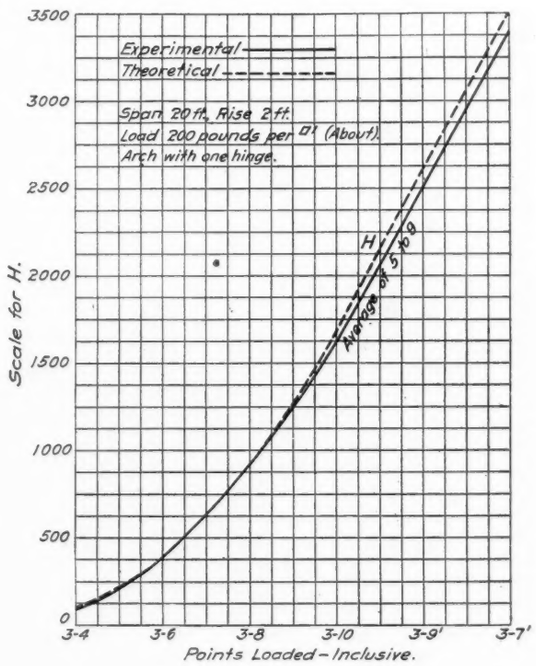


Fig. 8.

place of the plumb line. The bubble would "stick" enough under the slight change required to seriously affect the results.

Another explanation of the inability of getting two consecutive results, for the same loading, to agree was the lag in the adjustment of the arch material itself—or hysteresis.

If a block of concrete be tested in compression and an autographic stress strain curve drawn it will be made up of a series of loops if the load is alternately applied and released, the size of each loop depending to some extent upon the time element (Fig. 4). The time required for the loop curve under a decreasing load to return to zero under no load is quite long and apparently in some cases the zero is never reached —that is, the molecules have a new arrangement and the specimen has what appears to be a permanent set.

This effect appeared in all the arch experiments and was complicated by the fact that different portions of the arch were under stresses of different intensities.

It was impossible to wait long enough between weighings to permit the lag to catch up, so to speak, on account of the non-feasibility of keeping the temperature of the room constant for long intervals. The time element was ignored and the result showed that no harmful effects followed.

To illustrate this lag, the following log of one run of weighings is given:

Log of One Run.

Points loaded.	Lever 1, lbs.	Lever 3, lbs.	Lever 4, lbs.	Remarks.
Empty.	1,180	1,380	2.263	Temp. 69¾ deg. F.
3-4	1,195	1,390	2,389	
3-6	1,304	1,323	2,835	
3-8	1,423	1,308	3,471	
3-10	1,515	1,385	4,225	
3-9 ft.	1,501	1,550	5,070	
3-7 "	1,607	1,855	5,740	
3-9 "	1,610	1,537	5,104	
3-10	1,560	1,338	4,320	
3-8	1,464	1,265	3,596	
3-6	1,313	1,321	2,889	
3-4	1,242	1,341	2,519	
Empty.	1,194	1,367	2,309	Temp. 69½ deg. F.

It is noticed that, for the arch empty, at the end of the run the weight on lever 1 is 14 lbs. larger than at the beginning, and that on lever 3 the weight is 13 lbs. smaller, making the total vertical reactions agree within one pound. This readjustment of the weights is more or less true for all observations. In the case of lever 4, which weighs the horizontal pull, the first and last reading differ by 36 lbs., a discrepancy slightly greater than 1 per cent.

*The formulas used in computing the values of H. M and V are as follows:

$$H_1 = \frac{\Sigma\, m_x\, \Delta \left(y - \frac{\Sigma\, y\, \Delta}{\Sigma\, \Delta}\right)}{\Sigma\, y\, \Delta \left(y - \frac{\Sigma\, y\, \Delta}{\Sigma\, \Delta}\right)}$$

$$H_a = H_1 \left\{ 1 - \frac{\Sigma\, y\, \Delta \left(y - \frac{\Sigma\, y\, \Delta}{\Sigma\, \Delta}\right)}{\Sigma\, y\, \Delta \left(y - \frac{\Sigma\, y\, \Delta}{\Sigma\, \Delta}\right) + \Sigma\, \frac{(\delta x)^2}{F_x \delta s}} \right\}$$

True:

$$H = H_1 - H_a$$

Where

H_1 = the horizontal thrust neglecting the effect of the axial thrust.

H_a = the horizontal thrust due to the axial thrust.

H = the true horizontal thrust.

m_x = the common moment for the given loading on a simple beam supported at the ends, or

$m_x = R - \Sigma\, P\, (x - a)\; x > a.$

$\Delta = \frac{\delta s}{I}$ where I = moment of inertia of cross section.

$\delta s = \delta x \div \cos \phi$ and $\delta x = \frac{1}{20}$ span.

F_x = area of cross section.

Σ = summation between A and C.

Other nomenclature is evident from Fig. 6.

The value of H_1 was first computed for each load, and then the value of H_a, which is simply a constant percentage of H_1 regardless of the loading and its position. Of course, this last statement is not absolutely true, but very nearly so. The true value of H can now be found by percentage. In this particular case the true H is only about 76 per cent. the common H which is used by a great many in every day practice. As pointed out by the writer in his Treatise on Arches, the effect of the axial thrust should not be neglected when flat arches are used. The comparison of the results obtained from the above formulas and by experiment, show in Fig. 7, is a very conclusive verification of this statement.

For the bending moment at the south end:

$$M = H\, \frac{\Sigma\, y\, \Delta}{\Sigma\, \Delta} - \frac{\Sigma\, m_x\, \Delta \left(x - \frac{\Sigma\, x^2\, \Delta}{\Sigma\, x\, \Delta}\right)}{\Sigma\, \Delta \left(\frac{l}{2} - \frac{\Sigma\, x^2\, \Delta}{\Sigma\, x\, \Delta}\right)}$$

and for the vertical reaction at the south end:

$$V = \frac{M_1 - M}{l} + (R = \text{common reaction}).$$

M_1 = moment at north end of arch.

Symmetrical Masonry Arches, by Malverd A. Howe. John Wiley & Sons, New York.

The comparative values of M are shown in Fig. 7.

The agreement between the theoretical and experimental values is not as close as for the values of H. The maximum discrepancy amounts to an "error" in the weights on beams 1 and 3 of +25 and —25 lbs., respectively, which corresponds to an exceedingly small movement of the "head."

The values of V, shown in Fig. 7, are in close agreement as might be expected.

These experiments show that the summation formulas can be depended upon to give the correct values of H, M and V for reinforced concrete arches, provided, however, that the conditions upon which the formulas are based are fulfilled by the structure as built. A very slight change at the support does seriously affect the values of H and M. This is according to theory and experiment and probably partially explains why so many concrete and stone bridges show cracks, especially where abutments are founded on piles.

As a matter of curiosity a set of readings was made, considering the arch as fixed at the north end and *hinged* at the south end. The results are shown in Fig. 8. The maximum discrepancy is small, but not as small as found for the fixed arch. This is undoubtedly due to the slight rotation of the point selected as limiting the length of the span. The only point which could be correctly employed would be one opposite the center of the south axis pin. A mark on the end of this pin could not be used, as it deflected different amounts according to the pulls of levers 2 and 4. The glass plate used for the fixed arch was set approximately opposite the center of the pin, with the arch empty, and used in all experiments. If this was not exactly right it would change its position slightly as the "head" changed its position by rotating around the pin.

The arch and all weighing apparatus was constructed by Messrs. W. W. Kelley, E. J. Miner, W. R. Plew and R. A. Strecker, members of the class of 1907. These gentlemen also made a series of experiments, which were not considered satisfactory and owing to lack of time, they were unable to locate the errors. The work was continued by Messrs. C. B. Andrews and P. G. Lindeman, members of the class of 1908. They were able to eliminate a number of errors and, finally, when their time was about up, they were able to obtain satisfactory results.

The writer is greatly indebted to all of these gentlemen for their hard and conscientious work throughout the time at their disposal.

UNIT COST OF CONCRETE BUILDINGS.

It has been a common method to estimate the approximate cost of a building by either the square foot of floor or the cubic foot of space enclosed. In a recent paper, Leonard C. Wason, President of the Aberthaw Construction Company, Boston, Mass., presents numerous comparative costs obtained through his own experience and states as his conclusion that "after making this comparison he is convinced that neither method is accurate enough to put much reliance on, but that the square foot method is a little safer than the other." Four of the tables from his paper are presented herewith. In each case the total cost includes masonry and carpentry work without interior finish or decorating, plumbing and heating. The effort has been made to put the buildings upon a comparative basis as regards the amount of work done on each.

The first table consists of the total cost of actual contracts executed. The second table consists of bona fide bids on complete buildings on which Mr. Wason's company were not the lowest bidders, but where the difference was not as a rule very great. The third and fourth tables are bona fide bids on work by another contractor whose experience was similar to that of Mr. Wason's. As a rule, cubic foot measurements are given in cents only, seldom being carried to any closer subdivision. In reference to Table 4 on second class buildings, it

will be noted that for the largest building a variation of one cent per cu. ft. amounts to over twenty-eight thousand dollars, while the smallest one in the list amounts to only a little over fifty-four hundred dollars. Again, on the last three items, the cu. ft. price is practically identical, while the corresponding square foot measurements vary by more than 100 per cent. with no easily apparent reason in the design.

In Table 3 another discrepancy is noticed. In the first and the last items, the highest and lowest per cu. ft. as well as per sq. ft. are on office buildings of similar types which were within one mile of each other where there is no apparent reason for such discrepancy in the design or difficulty of access in the erection of the building. It is recommended by Mr. Wason that very little reliance be placed upon this class of estimates.

TABLE No. 1.—*Cost of Fireproof Completed Contracts.*

Kind of building.	Job cost.	Volume, cu. ft.	Floor area, sq. ft.	Unit cost— Cu. ft.	Unit cost— Sq. ft.
Offices and stores...	$181,194	1,365,830	90,474	$0.133	$2.00
Offices and stores...	61,646	496,780	39,840	.124	1.545
Factory	12,774	112,440	7,519	.114	1.70
"	44,652	746,674	49,543	.060	.902
"	39,830	312,000	24,960	.127	1.60
Garage	10,436	156,198	10,806	.085	1.23
Filter	19,993	149,250	19,208	.134	1.04
Fire station	6,757	44,265	2,982	.153	2.26
Observatory	3,625	9,734	657	.373	5.45
Filter	20.076	59,991	5,243	.333	3.82
Highest				.333	3.82
Lowest				.060	.90
Average				.138	1.72

TABLE No. 2.—*Cost of Fireproof Complete Buildings.*

Kind of building.	Job cost.	Volume, cu. ft.	Floor area, sq. ft.	Unit cost— Cu. ft.	Unit cost— Sq. ft.
Storehouse	$141,755	1,714,448	168,696	$0.0827	$0.84
Hospital	60,800	703,692	57,654	.0865	1.05
Office building	61,646	496,780	39,840	.124	1.545
Cold storage	200,051	1,535,000	154,000	.13	1.30
Factory	19,292	212,400	15,000	.091	1.28
Factory	141,529	1,327,868	106,022	.107	1.335
Storehouse	76,796	1,140,000	146,000	.0685	.575
Manufacturing bldg..	91,377	1,380,500	90,240	.067	1.01
Office	136,880	693,840	56,552	.197	2.42
Factory	13,064	105,600	8,800	.124	1.485
"	75,604	1,211,364	74,604	.0625	1.01
"	23,332	180,000	16,394	.129	1.42
Highest				.197	2.42
Lowest				.0625	.575
Average				.1088	1.27

TABLE No. 3.—*Cost of Fireproof Buildings.*

Kind of building.	Job cost.	Volume, cu. ft.	Floor area, sq. ft.	Unit cost— Cu. ft.	Unit cost— Sq. ft.
Office building	$70,690	441,000	35,854	$0.159	$1.97
Cold storage	132,365	1,016,400	101,640	.13	1.30
Hospital	44,451	348,320	34,832	.127	1.27
Hospital	51,574	414,732	29,838	.124	1.73
Bank	65,580	533,750	....	.123	....
Masonic	180,197	1,479,456	....	.122	....
Warehouse	31,280	259,700	24,500	.120	1.28
Garage	59,105	497,420	....	.118	....
Warehouse	275,723	2,597,000	212,000	.106	1.30
Hotel	220,646	2,116,106	....	.104	....
Hospital	49,724	485,789	38,247	.100	1.30
Office	25,151	264,687	....	.095	....
Cold storage	82,711	909,240	66,745	.091	1.24
Club	43,586	513,808	....	.085	....
Office	60,003	501,575	67,400	.084	1.12
Highest				.159	1.97
Lowest				.084	1.12
Average				.113	1.39
5 variation high and low, per cent.....				53.8	57.0

TABLE No. 4.—*Cost of Mill Construction or Second Class Building.*

Kind of building.	Job cost.	Volume, cu. ft.	Floor area, sq. ft.	Unit cost— Cu. ft.	Unit cost— Sq. ft.
Mill	$66,516	544,788	44,172	$0.122	$1.51
Warehouse	337,000	2,808,850	....	.12	....
Mill	113,288	1,271,300	129,920	.0891	.875
Storehouse	101,098	1,714,448	168,696	.059	.60
Mill	90,703	1,622,128	152,200	.056	.60
"	72,048	1,331,200	83,200	.054	.865
"	85,754	1,752,609	81,500	.048	1.05
"	122,128	2,641,000	98,059	.046	1.25
"	94,341	2,036,731	174,000	.046	.542
"	129,405	2,867,535	157,730	.045	.82
Highest				.122	1.51
Lowest				.045	.542
Average				.069	.90

FOREIGN RAILWAY NOTES.

The railway from Singapore, India, to Penang, opening up a valuable rubber district, has been finished.

The French have completed their railway from the east coast of Madagascar inland to Tananarivo, the seat of government, a distance of 181 miles. It is of metre gage and has cost $19,500,000.

The Universal Supply Co. and the Siemens-Schuckert Co. are urging the building of an electric railway between Cologne, Germany, and Dusseldorf, about 25 miles. These equipment companies offer to finance and build the road if the cities will not furnish the money.

There is talk of advancing the passenger fares on the Swiss railways during the three summer months, when the country is full of travelers from other countries. It is argued that most of the visitors who would be kept away by the higher fares then would still visit the country earlier or later, when the hotel charges are reduced as well as, by this scheme, the fares. But Switzerland is a small country, and the cost of travel in it, even at high rates, is not great. The cost of getting to it is a much more serious matter.

COMPARATIVE COST OF FUEL OIL MOTOR CAR AND STEAM LOCOMOTIVE SERVICE ON ROCK ISLAND.

During the months of November and December, 1908, and January, 1909, the Chicago, Rock Island & Pacific used, on its Salina branch, a motor car which was built by the American Locomotive Company. The run from Herington, Kan., to Salina is 49 miles. The motor car was operated 47 days during these three months, making a total mileage of 4,975 miles. The average cost of operation per mile in November was 15 cents; in December 18.5 cents and in January 20.4 cents.

In January the motor car was in service five days and the service for the balance of the month, 26 days, was performed by a steam locomotive and train, making a total mileage of 2,548 miles, and the average cost per mile was 17.31 cents. The train was made up of one combination car and one coach, the two having a total weight of 60 tons. The locomotive was an 8-wheel engine with cylinders 18 in. x 24 in. and drivers 64 in., weight on drivers 54,400 lbs., weight of engine 89,000 lbs., weight of engine and tender, 80 tons, and the weight of engine and train, 140 tons.

The motor car was illustrated in the *Railroad Age Gazette* September 18, 1908, page 961. The total weight of the car is 100,000 lbs.; weight on drivers, 32,400 lbs., the cylinders are compound, 9¼ in. and 14½ in. x 12 in. stroke. The boiler is of the return tubular type with working pressure 250 lbs. Its total heating surface is 624 sq. ft. and it is furnished with a superheater. The maximum power of the engine is 250 h.p. The car is 55 ft. 9 in. long. It has engine and baggage compartments and a seating capacity for 40 passengers. Much of the time the motor hauled the coach as a trailer and the total weight was then 130 tons, but the oil consumption was not materially increased over that of the motor car alone.

The table below gives in detail the items making up the cost per mile of the motor car performing 20 days' service in November, 1908, when it made a total mileage of 2,325 miles, compared with the locomotive and train which performed 26 days' service in January, 1909, and made a mileage of 2,548 miles.

	Average cost per mile.— Motor car. 20 days. Nov., 1908.	Loco. and train. 26 days. January, 1909.
Fuel oil	3.35 cts.	5.64 cts.*
Wages, enginemen	3.15 "	6.80 " †
Wages, conductor	2.15 "	2.48 "
Running repairs	4.13 "	0.51 "
Cleaning	0.96 "	0.37 "
Roundhouse service	0.62 "	0.57 "
Miscellaneous supplies.....	0.56 "	0.56 "
Oil and waste	0.21 "	0.18 "
Total	15.13 cts.	17.31 cts.

*Coal.
†Fireman included.

It is now intended to further experiment with the motor car on a short stub run of 5 miles with frequent service between Atchison and Rushville.

INDIANAPOLIS-TERRE HAUTE DOUBLE TRACK OF THE BIG FOUR.

During the past three years the Cleveland, Cincinnati, Chicago & St. Louis has been rebuilding its St. Louis division between Indianapolis, Ind., and Terre Haute. The work involved the conversion of a single track, heavy grade line into a double track, low grade railway, fully equipped with all modern facilities, permanent structures and a track superstructure of sufficient weight to meet the requirements of the heaviest existing class of traffic and equipment. In addition to the second track work, the ruling gradient was reduced from 1 per cent. to 0.4 per cent., with a material reduction in curvature and in rise and fall.

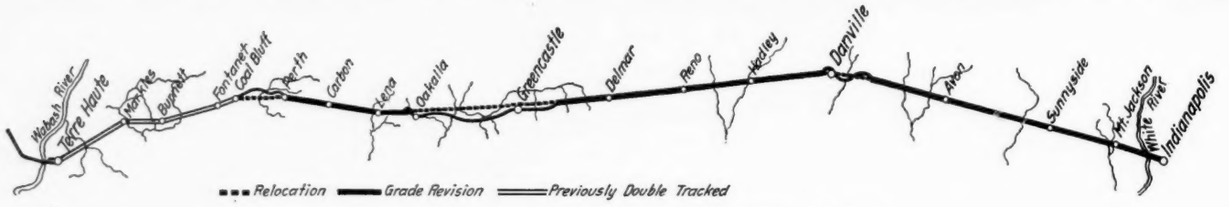


Fig. 1—St. Louis Division Reconstruction; Big Four.

Going westwardly from Indianapolis, the old single track line traversed a rolling country and, because of the relatively heavy maximum gradient, was much broken, there being many summits and sags. The alinement was, in general, excellent, there being only three points where curvature was detrimental. These were the crossings of White Lick creek, near Danville, Ind., and the Little Walnut and Big Walnut creeks, in the vicinity of Greencastle and near Perth, respectively. From the latter point, the old line followed a contour location, passing down the valley of Otter creek to the Wabash bottoms. At Danville a relocation of 2.7 miles long was made, the old track being crossed twice within a mile and 39 deg. of curvature eliminated. At Greencastle a relocation 11.1 miles long, involving the elimination of 518 deg. of curvature and crossing the old main track once, was adopted. The greatest departure from the old line was opposite the small station of Oakalla, where the new and old locations were a mile apart. Near Perth, where the old line followed the contour location up the valley of Otter creek, a double curve was eliminated by heavy cuttings and embankments. Except at the points mentioned, the new track was built adjacent to the old right-of-way, but owing to the modification in grade line not a single foot of the original roadbed was left undisturbed.

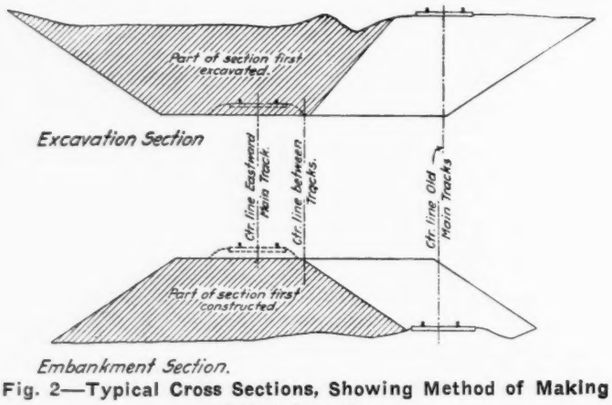


Fig. 2—Typical Cross Sections, Showing Method of Making Offset Location.

To accomplish the grade reduction and double tracking with minimum disturbance to the heavy traffic on the existing line, the method of "offset" location was adopted, as with the Cairo division work described Feb. 26. This offset location was laid as close to the old main track as possible in order to minimize the need for additional right-of-way, improvements adjacent to the original right-of-way making land very costly in some localities; and also in order to utilize, so far as possible, the original cuttings and embankments, thus minimizing the earth work. The new grade line intersected vertically the grade of the old track 35 times, and at no place had the same direction, the maximum differences in elevation being about 30 ft. in cuttings and 22 ft. in embankments. In addition to this, because of errors in the original location, numerous "swings" existed in the old track, and the elimination of these irregularities in alinement necessitated crossing the old track eight times with the offset location, the offset distance varying from zero to 68 ft. Thus, the new double track cross-section partially overlapped, and in some places completely covered, the old track section in embankments, and partially or entirely absorbed it in the cuttings, depending on the offset distance. The general method followed in the location was to adjust the offset distance to the difference in grade in such a manner that a part of the new section, wide enough to support one new main track, could be built without encroaching upon the existing track. A typical cross-section (Fig. 2) illustrates this method.

Upon the completion of track superstructure over any one

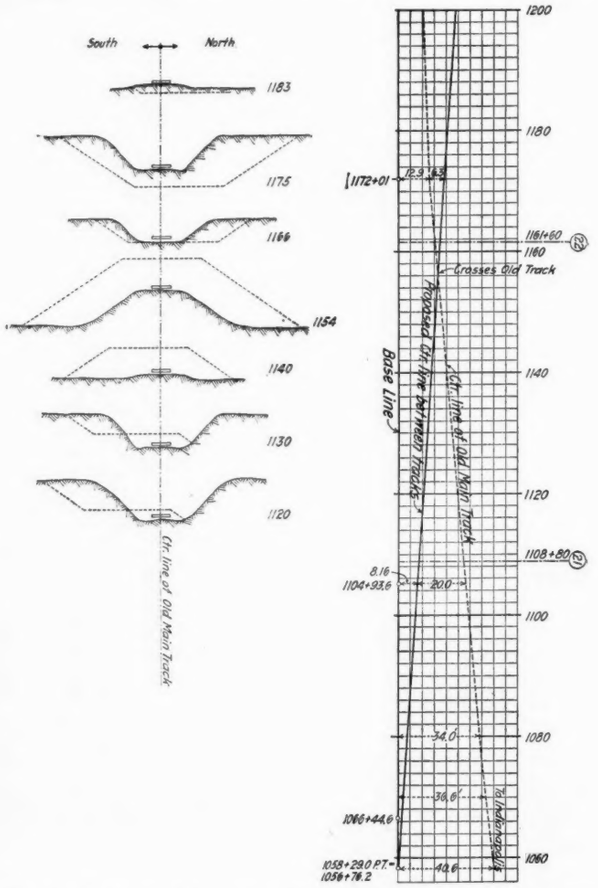


Fig. 3—Method of Locating New Tangent from Base Line.

stretch of embankment or excavation, or in some cases both, the old track was connected to the new track at points where the grades were coincident, and the new track was operated as a part of the old single track line. In some cases it was deemed advisable to throw the operated main to a temporary location to give more room for the new section, or to widen slightly the new section on the shoulder to avoid interference with the operated main. However, the nicety of adjustment obtained was such that very little of the new main track had to be built in a temporary location and only in three short stretches was the old main track disturbed prior to its being removed altogether.

It should be mentioned that the need for continuing the operation of the busy line without undue delay added greatly to the difficulty of the work. The St. Louis division not only has a heavy freight movement, but also a fast passenger line, being the through connection for the New York Central Lines' traffic to St. Louis and the Southwest. During all the time of reconstruction there was a passenger train movement alone of 16 to 18 trains a day. At no time during the progress of the work was it necessary to lengthen the schedules because of construction conditions.

The method of determining the offset location is of interest. The long tangents were fixed by running a base line and taking offsets to the existing track, which had numerous swings, as already mentioned. The base line thus obtained was plotted to show graphically the position of the old main track. From this the final position of the new tangent was obtained, which was then laid out on the ground, minor adjustments being made in the field. This method of adjusting the offset location to the old track is illustrated in Fig. 3.

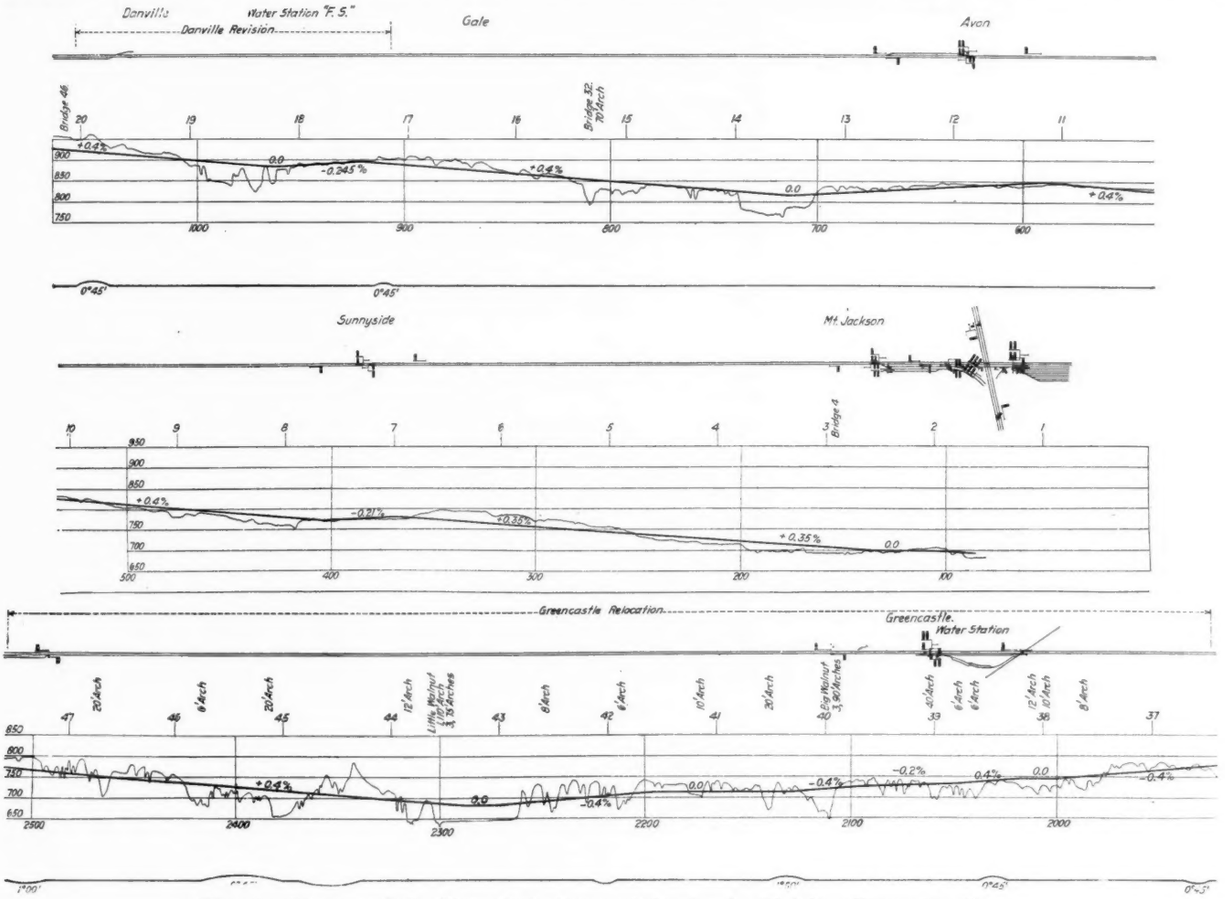


Fig. 4—Plans and Profiles of Sections of St. Louis Division Reconstruction.

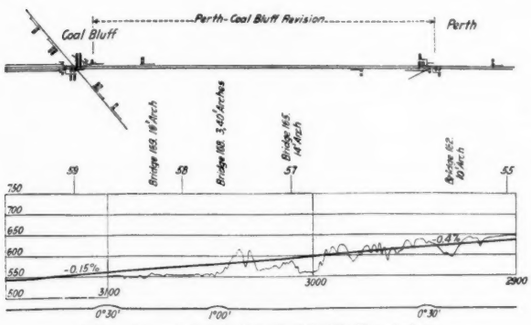


Fig. 4a—Perth-Coal Bluff Revision.

The features of the Greencastle relocation were: (1) the extremely heavy earth work involved; (2) the crossings of the two branches of Walnut creek—Big Walnut and Little Walnut; (3) the elimination of a grade crossing with the Chicago, Indianapolis & Louisville; (4) the relocation of the Greencastle station facilities, the station being moved a mile from its original location, and (5) the elimination of the small station of Oakalla.

Two principal methods were adopted by the contractors in building the embankments: (1) the ordinary method of dumping from trestles, either with standard or narrow gage equipment, and (2) raising an independent unloading track. The latter method was particularly applicable to the offset locations where a large part of the material could be dumped from the old main track, the contractors being allowed to operate over this track under proper protective precautions. Some of the larger fills were made in two lifts. A trestle some 20 ft. high was first built, and the fil brought to this level; then another trestle, equally high perhaps, was built on top of this and the rest of the embankment deposited from it. This

method gave good results, as it made a compact fill. A large part of the work was carried on both day and night, a feature of the night work on the Greencastle relocation being the installation of a complete electric lighting plant.

The total earth involved in this work was about 6,500,000 cu. yds., there being at one time as many as 27 steam shovels in operation, with the necessary dump cars, engines, unloaders, etc., together with a large force of teams. Almost every known method of handling earth was involved, including steam shovel outfits with narrow gage cars or standard gage cars of the "Western" type, of both 5-yd. and 12-yd. capacity; standard gage flat cars unloaded with Lidgerwood machinery and plow; teams drawing slips, wheelers, or wagons loaded by an elevating excavator; steam shovels of various weights from 55 to 90 tons, together with the incidental equipment necessary to the successful handling of heavy earth and rock work.

The character of bridge construction is similar to that on the Cairo division, being permanent and designed to carry the heaviest wheel loads. With but four exceptions the bridges are of reinforced concrete. For the smaller openings the simple arch, or box type, was used; for the larger structures, particularly where the grade line crossed a stream at a considerable elevation, arches of the spandrel type were adopted, with flanking arches forming the approaches. There are four bridges of this latter type; bridge 28, over White Lick creek; bridge 41, over White Lick creek, and the two Walnut creek bridges. The bridge over Little Walnut creek (Fig. 6) is of particular interest on account of its being on quite a severe skew. While not so high as the one over Big Walnut creek, it is similar in design, such differences as exist being due to the skew. The Big Walnut bridge, which is shown in the illustration (Fig. 7), consists of three 90-ft. spans, with a rise of 35 ft. The total length is 358 ft. and the tops of the parapet walls are 70 ft. above the bed of the stream.

Over the two branches of Eagle creek, immediately west of Indianapolis, and over the National road—a highway—lack of headroom necessitated the use of steel girders, the first two

Fig. 5—Plummer Hill Cut, on Greencastle Relocation.

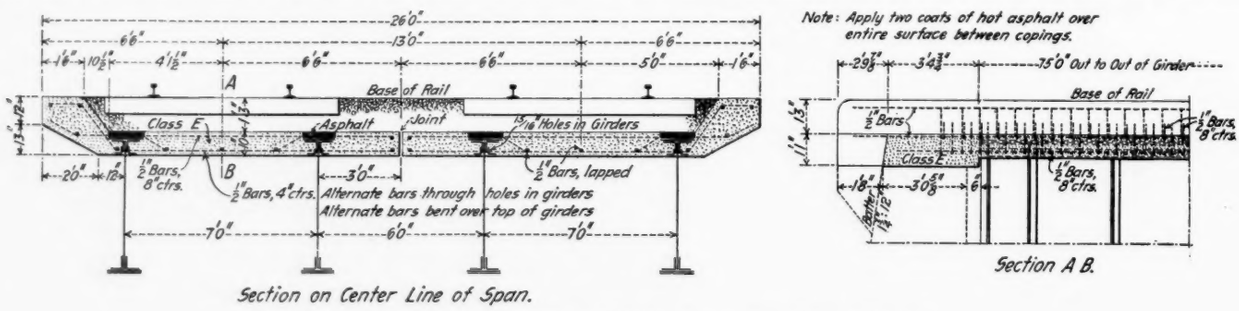


Fig. 8—Typical Sections of Solid Concrete Floor Bridges.

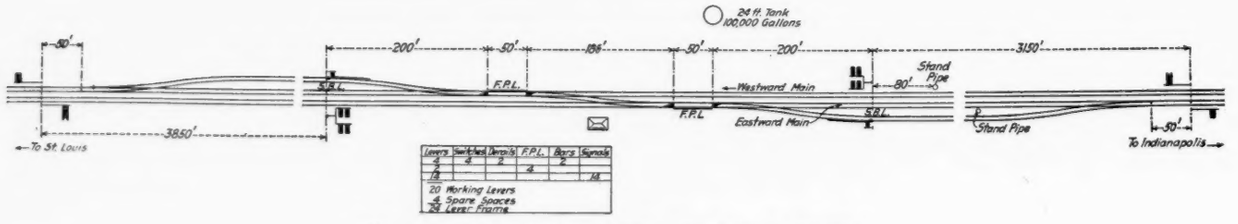


Fig. 9—Typical Plan of Signaling; Lena Station.

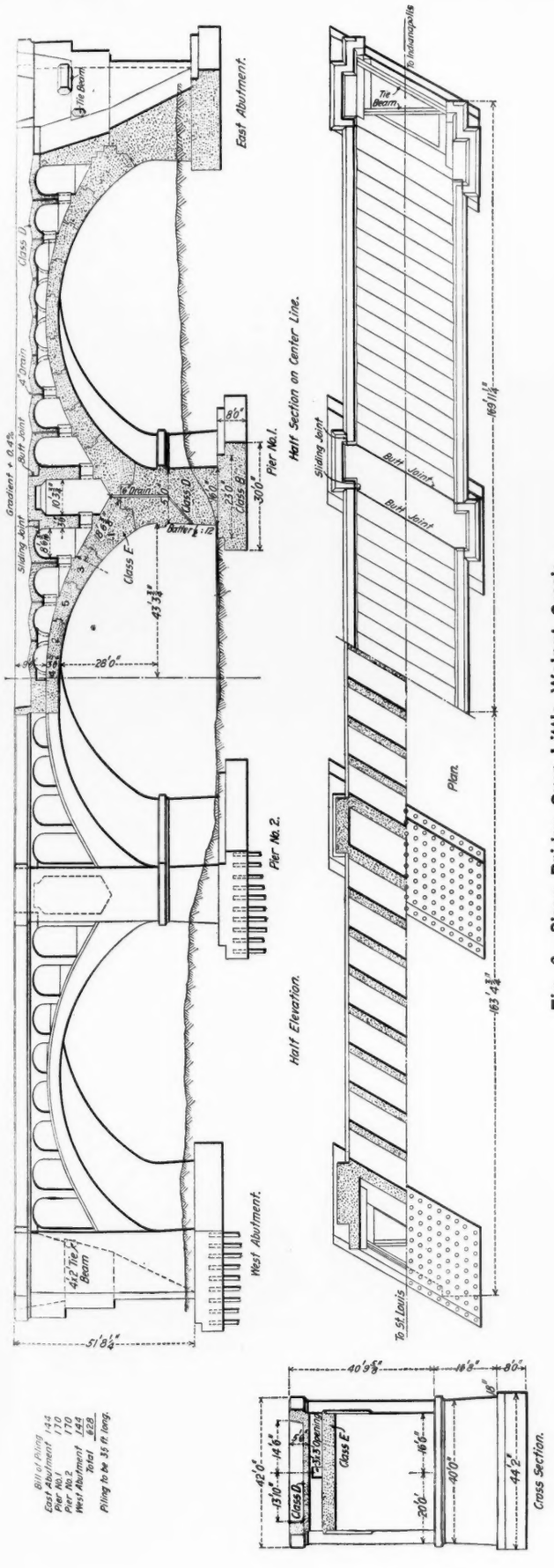


Fig. 6—Skew Bridge Over Little Walnut Creek.

being the deck type, and the last the through type. All three were given solid concrete floors. (Fig. 8).

At the overhead crossing of the Monon, lack of clearance necessitated through steel girders, and for the same reason an I-beam floor of the ordinary type was used, the rails running in a channel formed by the plates and Z-bars.

Several interesting structures provide for both a waterway and a highway in a single span. An instance is the crossing of the Crawfordsville road at Greencastle, which is spanned by a 30-ft. arch. Beneath the road, and extending diagonally

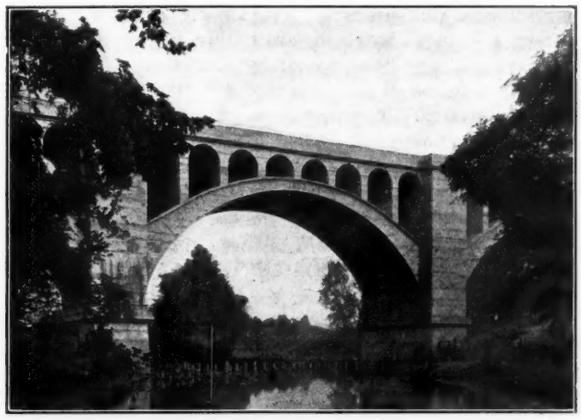


Fig. 7—Big Walnut Creek Bridge.

through the arch, a 5-ft. x 10-ft covered box conducts a small stream beneath the highway and railway at the same time.

Between Indianapolis and Coal Bluff, 60 highways cross the line of the railway. Of these 25 now cross at grade, 16 are overhead and 19 are undergrade. Twenty-three grade crossings on the old line were eliminated. The Railroad Commission of Indiana alluded to this elimination of grade crossings in its Bulletin No. 4, covering the second quarter of 1908, as follows:

"In this connection we desire to praise the Big Four Railway for taking out 23 crossings and putting in concrete bridges and subways in-

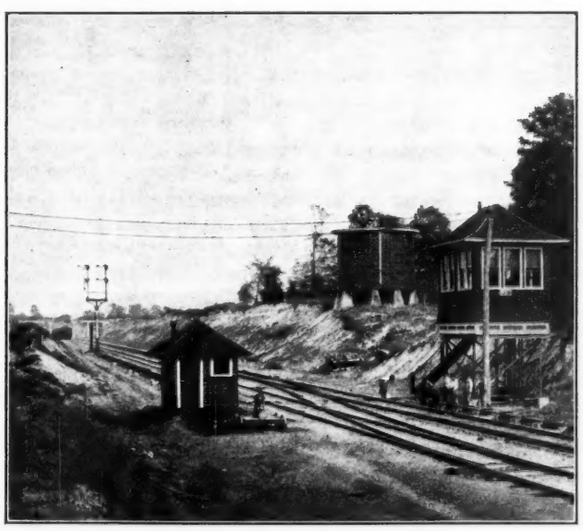


Fig. 10—Water Station and Tower at Lena.

stead, in the reconstruction work done by them between Indianapolis and Terre Haute."

The overhead crossings are of reinforced concrete of the same type as referred to in the Cairo division article, and also previously described in this journal.

To facilitate operation ample passing tracks were provided

at intervals as appeared advisable, due consideration being given to gradients. It will be noted from the typical plan herewith (Fig. 9), and the photograph (Fig. 10), that there are signals for high speed operation of the main tracks in both directions, the distant signals being placed 4,000 ft. in advance of the home signals and worked electrically. This is a feature of operation which is being used with notable success on the Big Four, the method being somewhat as follows:

The plan shows a trailing cross-over between mains. An eastbound passenger train of the second class, for example, has reached the block ahead of the block here shown. Following this second-class passenger train is an eastbound first-class passenger train. The second-class train is crossed over to the westward main at the preceding block station, which has a facing crossover, and proceeds to the station here shown under signal protection. The first-class train proceeds on the eastward main to the block station here shown and if it does not pass the second-class train before reaching this station the second-class train is kept on the westward main until the first-class train clears the block following. By this means some of the features of a four-track railway are introduced, so that traffic can be handled with great despatch under these conditions.

The advance block is also a notable feature, permitting a tonnage train to proceed until a descending gradient is reached, obviating the necessity of starting and stopping on a hill. The sidings are so arranged that a train which must take a siding will enter at the tower, the switch being thrown by the towerman, and the indication to the engineman that his train is to enter the siding is given by signals. Permission to proceed is likewise given by signals, a dwarf signal being put at the far end of the siding. When cleared, this signal opens an electric lock in the distant switch so that the brakeman may throw the switch and allow the train to proceed.

General improvements were made in the passenger and freight station facilities, particularly at Greencastle, where the new location necessitated an entire reconstruction. The illustrations show this new station.

Ample water station facilities were provided, one being at Lena, 8 miles west of Greencastle, one at Delmar and one at Danville. The first-named receives its supply from a reservoir which was made by equalizing the embankment of the railway by a dam, providing a supply which is ample to carry the service over the dryest seasons. At Danville the water is taken from the bed of White Lick creek, and at Delmar it is pumped from deep wells. Tanks of 100,000 gals. capacity, with the necessary pumping stations and water cranes, have been installed.

The construction work, which was completed last fall, was done under the direction of W. M. Duane, who recently resigned as chief engineer of the Big Four, and F. W. Smith, construction engineer. Joseph Mullen was in immediate charge as division engineer.

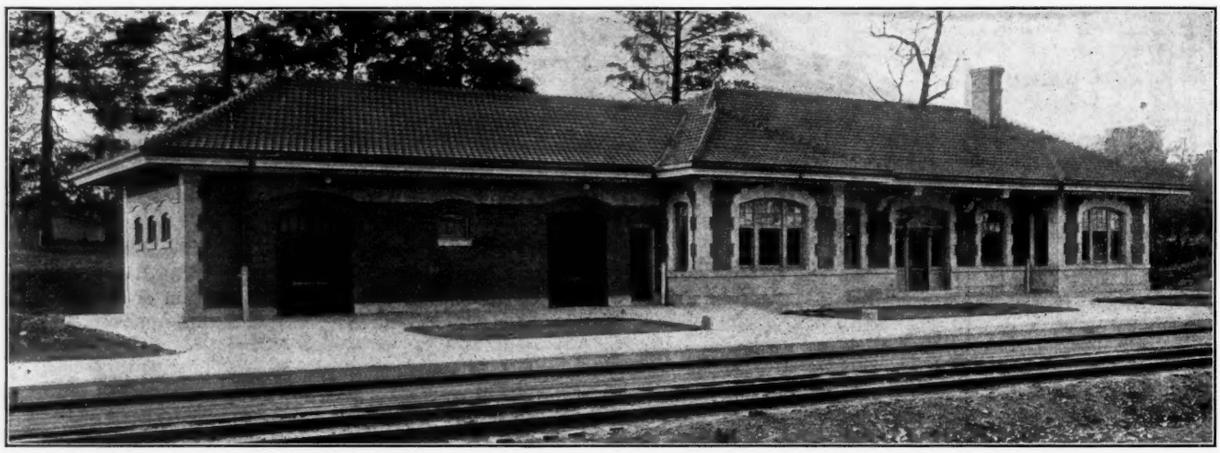


Fig. 11—New Passenger Station at Greencastle.

TIE TREATMENT WITH CRUDE OIL ON THE MEXICAN CENTRAL.

After five months' work the tie treating plant of the Mexican Central at Aguascalientes, Mexico, has reached an output of 3,500 ties per day. The treatment, which now consists of Ebano oil, is interesting for the reason that with one exception, in the United States, the Aguascalientes plant is the first in the history of railway operation to make a distinct success of the crude oil process for the treatment of ties. Although it is too soon to judge from actual experience of the effect of the oil, it is expected that the treatment will prolong the life of each tie from eight to twelve years. The process as used there consists of placing the ties in cylinders which are then filled with oil and subjected to heat and pressure. After seven hours the oil is forced out of the cylinders and the ties removed. The average tie treated absorbs about seven kilos of oil, or more than three gallons. The oil comes from Ebano and contains a large amount of solid matter, and it is this which is forced into the wood. The ties are Mexican pine, known as "Celaya," and then come from the region about 200 miles northwest of Mexico City. One cubic foot of this timber weighs 32 lbs. when air dried. Mexican pine is rather porous, as may be seen by its weight, and is somewhat brashy compared with good United States timber.

The average penetration into the pine ties treated here is about two inches. In harder woods it is less, but in all cases the oil acts as a water seal and will keep out moisture for years.

About a year ago the Mexican Central Railway undertook some experiments to determine the practicability of using crude petroleum from the wells at Ebano, near Tampico. This oil is the same as that which has been used during several years as locomotive fuel. The content of asphalt is very high, the viscosity of the oil being such that, as in the case of other heavy oils, it is necessary to force it to the burners under air pressure after being heated to about 120 or 140 deg. F. in the tender tanks.

An average analysis of the Ebano oil shows the specific gravity at 15 deg. C. 98 to 99 or ordinarily 12.4 deg. Baume. Viscosity at 21 deg. C. 48,900 degs. Flashpoint 106 deg. F. Naphtha and illuminating oils about 20 per cent. and asphalt about 60 per cent.

Before permanently changing the zinc chloride plant to oil a large number of experiments were carried out with a view

to determining the probable cost of the new method with different degrees of saturation of the timber, as well as the probable length of time necessary, or the probable capacity of the existing zinc chloride plant when converted. A miniature treating plant was constructing, with an experimental cylinder large enough to accommodate two ties and connected by pipes to several of the shop power house auxiliaries. An oil pipe led from the pressure side of one of the fuel oil feed pumps to this cylinder, arranged for blowing back through a by-pass around the pump to the suction side and supply tank. Other pipes connected the cylinder with the compressed air mains and the condenser. Heater pipes with heating surface about proportional to that in the large tie plant cylinders were also connected through a reducing valve with the steam mains.

The results of experiments made in a small cylinder are not in all respects applicable to large cylinders of several hundred ties capacity, the principal difference in this case lying in the fact that the oil being very heavy the heating of the oil among the ties will be slow because of the slow circulation. In the actual plant the steam pipes being placed around and between the tracks, the heating of the oil at any distance from these pipes is liable to be slow. The results of the experiments were, however, used to some extent in determining a proposed method of treatment and the general plan of the changes to be made in converting the plant to oil, all subject to modification as experience with the actual plant should indicate. As the experiments are of considerable interest as indicating what results may be sought for in the design of new plants, a summary of the methods and results

RESULTS OF A FEW REPRESENTATIVE TESTS.

Test No.	1.	2.	3.	4.	5.	6.	7.	8.	9.
Time in preliminary vacuum (27 in.), minutes	Omitted.	Omitted.	Omitted.	Omitted.	6.0	Omitted.	Omitted.	30.0	Omitted.
Air pressure, absolute, lbs.	"	72.0	72.0	72.0	Omitted.	42.0	52.0	Omitted.	Omitted.
Time under air pressure, minutes	"	60.0	45.0	.....*	Omitted.	45.0	60.0	Omitted.	Omitted.
Time under oil pressure, hrs.	1.0	4.0	5.0	5.0	5.0	6.0	6.0	4.0	2.0
Temperature of oil, deg. F.	210.0	200.0	240.0	240.0	210.0	210.0	220.0	.....†	200.0
Oil pressure, absolute, lbs.	137.0	137.0	172.0	172.0	172.0	152.0	152.0	.....†	71.0
Time in vacuum (27 in.), minutes	35.0	60.0	40.0	45.0	60.0	60.0	60.0	45.0	90.0
Penetration at point under rail, in.	0.5	1.5	1.5	1.0	2.5	2.5	2.25	2.5	1.12
Per cent. of volume treated to total, per cent.	28.0	70.0	70.0	50.0	97.0	97.0	88.0	97.0	60.0
Absorption of oil, per cu. ft., gals.	1.1	0.42	0.61	0.53	2.36	1.36	0.95	2.71	1.31
Absorption of oil per tie of 2.7 cu. ft., gals.	2.97	1.13	1.65	1.43	6.37	3.67	2.56	7.32	3.54

*Air pressure applied, air valve closed and oil run in slowly, the air being blown off as the pressure became equal to the desired oil pressure.
†152 lbs. pressure held for 3 hrs. with a temperature of 170 deg. F. Pressure was then released and cylinder heated to 230 deg. for 1 hr. before applying vacuum.

is given. The different experiments were modifications in detail of the following general methods:

The valve in the condenser line was opened long enough to rid the cylinder and tie of air, after which oil was admitted, heated and held by the oil pump at from 90 to 140 lbs. pressure for from 2 to 6 hours, this being followed by vacuum. Short time or low pressures gave, of course, much less penetration than longer time, the results varying between the following extremes. One hour under 140 lbs. oil pressure at 200 deg. F. followed by 35 min. vacuum gave a penetration of one-half inch. The same conditions but with four hours' oil pressure gave a penetration of 2¾ inches from each side or over 95 per cent. of the volume of the tie saturated. Nearly complete saturation was obtained by preceding the injection of oil by a vacuum in order to remove the air, some of which it was observed gathered in a bubble in the center, preventing further penetration. When the preliminary vacuum was used this bubble was reduced to about ½ inch diameter.

These methods gave a tie rich in oil, but the process was correspondingly costly. The Mexican pine checks considerably when exposed to the Mexican climate and it was desired to secure considerable penetration without leaving the portions treated so rich as to make the probable life of a tie greater than its purely mechanical life under the rail. Trials were then made in which air under about forty pounds pressure and upwards was forced into the tie followed by modifications of the methods already mentioned. Sawn sections indicated that the oil being forced into the cylinder at a higher pressure as the air was blown out, further compressed what air was entrapped in the tie into a small bubble at the center and extending nearly throughout the length. This bubble upon expanding into the succeeding vacuum effectually cleared the pores of the timber of surplus oil, leaving the tie section so clean that sawn sections upon being rubbed would scarcely stain the finger. By varying the time that the tie was held under oil pressure more moderate depths of saturation were secured at very low cost for oil left in the tie. It was noted that the penetration was fairly uniform from the sides throughout the tie's length except where cracks or sun checks occurred, in which case the oil, of course, penetrated in all directions around the extent of the check. Penetration of the timber through the ends and following the fibers which it is sometimes assumed is extreme, was not indicated by sawn sections. Trials made with timber having a fragment of bark on one side or edge showed that the penetration was radial, the sawn section showing an almost perfect triangle of untreated timber under the bark.

A table is given below which shows the principal results of a few of the more interesting tests. In addition to the methods shown in the table other trials were made with preliminary, intermediate, and after steaming of the ties, but it was found that nothing was gained by these methods. As this plant as well as the one or two other existing oil treatment plants is at a high altitude the pressures and vacuums have been reduced to absolute ease of comparison. Comparisons of different methods may be made from the table. For example, it may be noted that tests Nos. 6 and 7 were identical in all respects with the exception of the compressed air treatment. In test No. 7 the air pressure applied was ten pounds more than in No. 6, and was held fifteen minutes longer with the result that while the penetration was only ¼ inch less the saving in oil was over a gallon per tie. In other words, with nine per cent. less of the volume of the tie treated, the saving in oil was about 30 per cent.

During the experiments it was noted that any desired pressure could be obtained by the expansion of the oil when heated to a sufficient degree, usually below that generally supposed to be undesirable on account of injury to the wood fibers. The applicability of this method of getting pressure in the large cylinders was somewhat doubtful and it was found upon trial that a pressure pump was necessary. This indicated slow heating of the oil between the ties in the large cylinders where the circulation was slow, and suggests the desirability in the design of new plants of providing outside enclosed tanks of proper capacity (the volume of a cylinder minus the volume of a run of ties) with sufficient heating coils to heat the oil to a temperature nearly corresponding to the proposed cylinder pressure. The oil may then be run into the cylinders rapidly by means of high pressure air on these outside cylinders, the slower oil pump being used only for obtaining the higher pressure during saturation.

The conversion of the existing zinc-chloride plant to oil involved the rearrangement of certain of the usual piping from the solution tanks to the cylinders and the substitution of larger pipes to accommodate the slow flowing oil, the usual track pits for receiving and handling the oil, the removal of boilers to a safe distance, the installation of outside pressure

tanks, as above indicated, and proper fire protection. On account of the tendency of asphalt base oils to foam badly and overflow when heated, the last involved a system of perforated steam pipes over all open tanks so arranged as to entirely envelop the tanks in steam by operating any one of several quick opening valves placed both at convenient and at safe distances.

As the process has been used for but a short time no figures indicating the life of ties so treated are available. However, reports from other points which are using a somewhat similar treatment indicate that most excellent results are to be expected.

The Santa Fe commenced experimenting with crude oil for treating ties in 1901, and a few experimental ties were placed in track in February, 1902. These ties are still in good condition. At the meeting of the Maintenance of Way Association in March, 1907, Mr. Faulkner, of the Santa Fe, described their experiments as follows:

"We took thoroughly well seasoned ties with the cells more or less open and filled them with crude Bakersfield oil, which has a low gravity and an asphaltum residuum of about 77½ per cent., the balance being mainly light oils. This oil was heated to 180 deg. and forced into the ties under a pressure of 150 lbs. to the square inch. With this temperature a good proportion of the light oils had evaporated, leaving only an asphaltum residuum, which at that temperature was as fluid as creosote. Each tie took up about 4 gallons of oil, and it appears to have hardened in the cells under atmospheric temperature, so that after five years' service the ties are in first-class shape so far as preservation and wear is concerned. We do not claim that there are any antiseptic properties in the crude oil, but believe that by stopping up the open wood cells the substance which solidifies under ordinary temperatures would prevent heat, moisture and air from getting into the wood and thus prevent decay-producing organisms from beginning their work." The Santa Fe then prepared to erect in New Mexico new tie treating plants arranged for the use of crude oil at 150 to 200 lbs. pressure and a temperature of 180 deg. They also introduced the oil under a vacuum and at the end applied a low vacuum before drawing the ties out of the cylinder. In this way, the ties are reasonably cleaned, easily handled and the amount of oil used is considerably reduced.

THE BELT CONVEYOR IN RAILWAY BUILDING.

BY C. KEMBLE BALDWIN,
Chief Engineer, Robins New Conveyor Co.*

Every railway engineer is interested in apparatus which will enable him to handle material cheaply, quickly and with little labor. While many machines possess all of these qualifications, they are not adapted to railway building because they are too cumbersome, and are not sufficiently flexible to allow them to conform quickly to the varying conditions encountered.

The belt conveyor has a large field in railway work when once the engineers realize the many uses to which it may be put. Contractors who invest large sums of money in cars, derricks, steam shovels, cableways, etc., are beginning to realize that they may materially reduce their labor cost and their general handling cost by the use of the belt conveyor.

Belt conveyors are adapted to this class of service for the following reasons:

(1) They have large capacities.

(2) They require but little power when handling large quantities.

(3) They are light in weight.

(4) They will carry material horizontally and on an incline.

(5) The supporting structure is inexpensive and may be quickly erected, or it may be made up in self-contained portable sections.

(6) The entire apparatus may be quickly knocked down and cheaply transported from place to place.

(7) Because of its flexibility, a few hours' time is sufficient to change the length from 50 to several hundred feet.

The following brief description of the various parts making up the apparatus will be of assistance in considering the above claims made for the belt conveyor.

Idlers.—The troughing idlers which support the loaded belt consist of three or more pulleys turning on hollow shafts formed of cold-drawn steel seamless tubes. The tubes are carried by cast-iron brackets bolted to planks. The brackets have slotted bolt holes to permit the adjustment of the idlers on the plank to train the belt. The pulleys are lubricated by grease cups on the ends of the tubes forcing grease through the tubes to the bearings.

These idlers turn up the edges of the belt, forming a trough which not only prevents the material from falling off, but which centers the load on the belt, and supports the load between idlers. The return belt is carried flat by a series of pulleys turning on shafts of steel tubing, supported at the ends by clamp boxes and lubricated by grease cups on the tube ends.

The troughing idlers are spaced from 3½ to 5 ft. apart, depending on the weight per cubic foot of the material carried, and the amount being handled. The return idlers are usually spaced 10 ft. apart.

Belts.—Rubber-covered belts are most satisfactory for this class of service. Briefly, they are made as follows: The duck is coated on both sides with rubber, known as "friction." The frictioned duck is cut into the proper width and the belt is laid up to the desired number of plies. The rubber cover is then put on and the belt subjected to heat and pressure in the vulcanizing press.

The object of the duck is to give tensile strength to the belt. The friction sticks the plies together and the cover protects the duck from moisture and abrasion. It is necessary, therefore, that the belts be designed for the proper strength, and that the cover be proportioned to the service. If large quantities of rock are to be handled, a cushion of ⅛ in. to ¼ in. of rubber should be put on the upper side of the belt to protect the duck from the cutting action of the rock.

Driving Machinery.—The belt conveyor has an advantage over other types of conveyors, in that it may be driven at either end or from any point in its length. When properly designed the drive may be located at the tail or loading end and will prove as satisfactory as when at the discharge end. The largest heavy-duty conveyor ever built—1,000 ft. from center to center, handling about 400 tons of material per hour—is driven from the loading end. The power is applied to one or more of the pulleys over which the conveyor belt passes, thus imparting motion to the belt.

Discharging Devices.—Should it be necessary to discharge the material from the belt at any point between the two ends, either fixed or movable trippers may be used. The fixed tripper consists of two pulleys, one located above and ahead of the other. The belt passes over the upper pulley, then over the lower, in such a manner that the material is discharged from the belt into a chute which will carry it to one or both sides of the conveyor. The movab'e tripper is similar to the fixed tripper in form and operation, except that the two pulleys and the chute are mounted on a frame carried by four flanged wheels. It may, therefore, be moved the length of the conveyor either by crank or by power taken from the conveyor belt.

Having briefly described the various parts making up the belt conveyor, the various claims made for this piece of apparatus in railway work will be taken up in order.

CAPACITY.

The following table gives the capacity of conveyors from

*Old Colony Building, Chicago.

20 in. to 36 in. wide, in cubic yards per hour; also the maximum advisable speed, and the size of the largest pieces:

1. Width of belt.	2. Maximum size of pieces.	3. Capacity in cu.yds.at belt speed of 100 ft. p. m.	4. Maximum advisable speed in ft. p. m.	5. Capacity in cu.yds. at the max. advisable speed.	6. Power constant C.	7. H. p. required for each movble or fixed tripper.	8. W't of convey- or pr ft. in lbs. without structure.
20-in.	5 in.	47	300	141	.136	1¼	22
22-in.	6 "	58	300	174	.133	1½	25
24-in.	8 "	69	300	207	.131	1¾	29
26-in.	9 "	81	350	284	.127	2	32
28-in.	12 "	93	350	325	.121	2¼	34
30-in.	14 "	107	400	428	.117	2½	35
32-in.	15 "	122	400	488	.115	2¾	39
34-in.	16 "	137	450	617	.114	3	44
36-in.	18 "	155	450	698	.112	3¼	47

From the first five columns of the table it is evident that the belt conveyor is capable of handling all the material the largest steam shovel can dig, and more. When a steam shovel loads cars, much time is lost in shifting the cars and waiting for a new train to be pushed in. This necessarily cuts down the output of the shovel and increases the cost per yard. When conditions are such that a belt conveyor may be used in connection with a shovel there is no excuse for the shovel not handling its maximum quantity. The material being carried away in a continuous stream, there are no delays other than those due to the moving of the shovel and conveyor. In New England the coal hoisting towers on the docks take coal with grab buckets from the vessels and discharge to cable cars which carry the coal to storage. Usually the capacity was determined by the capacity of the cable road. Many of these plants have been increased 50 per cent. in capacity by replacing the cable road with belt conveyors of a capacity larger than that of the hoist. This caused the hoist to work to its maximum to load the conveyors, there being no delays waiting for cars. This applies as well to steam shovel operation.

POWER.

Conveyor belts should never be run at a speed greater than that required to carry the desired load, and the power should be figured for the maximum load at the chosen speed. The following formula will give the power required:

C = Power constant from column 6 of table.
T = Load in tons per hour.
L = Length of conveyor in feet between centers.
H = Vertical height in feet material is lifted.

For level conveyors,

$$\text{H.P.} = \frac{C \times T \times L}{1000}$$

For inclined conveyors,

$$\text{H.P.} = \frac{C \times T \times L}{1000} + \frac{T \times H}{1000}$$

Add for each movable or fixed tripper the horsepower in column 7 of the table.

Add 20 per cent. to horsepower for conveyors under 50 ft. in length.

Add 10 per cent. to horsepower for conveyors between 50 ft. and 100 ft. in length.

The above figures do not include gear friction.

Assume a 30-in. level conveyor 150 ft. long, carrying 300 tons per hour at a speed of 200 ft. per minute. It would require

$$\frac{.117 \times 300 \times 150}{1000} = 5\tfrac{1}{4} \text{ H.P.}$$

Or a 36-in. level conveyor 300 ft. long carrying 630 tons per hour at a speed of 300 ft. per minute would require

$$\frac{.112 \times 630 \times 300}{1000} = 21\tfrac{1}{4} \text{ H.P.}$$

If the conveyor is inclined, add the horsepower required to lift the load to the required height, using the formula for inclined conveyor.

From this data it is evident that the belt conveyor will move very large quantities with very little power. Electric motors, steam or gasolene engines may be used according to convenience.

WEIGHT.

Column 8 of the table gives the weight of the various widths of conveyor per foot. This weight includes 2 ft. of belt and the proportion of the weight of troughing, return and guide idlers. The weight of the driving mechanism will depend on the length and duty of the conveyor. From these figures it will be noted that when the large capacity is taken into consideration the apparatus weighs remarkably little.

ARRANGEMENT OF CONVEYORS.

Fig. 1 A shows in outline the simplest form of level conveyor receiving material at one or more points and discharging over the end pulley.

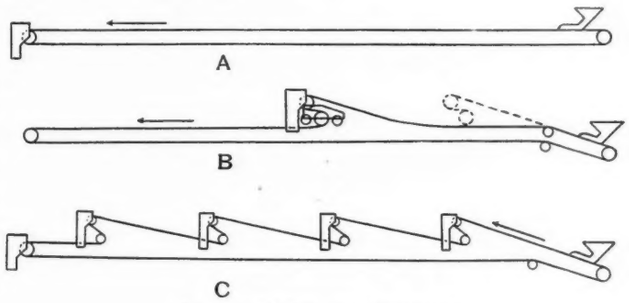


Fig. 1—Styles of Conveyors.

In Fig. 1 B the material is received at one end and discharged at any point by a movable tripper.

Fig. 1 C is a level conveyor with a series of fixed trippers.

Fig. 2 A shows a simple inclined conveyor. Practically any material in a railway excavation may be handled at an angle of 20 deg. to the horizontal. Inclined conveyors should not be run at high speeds, as the material must be given the same

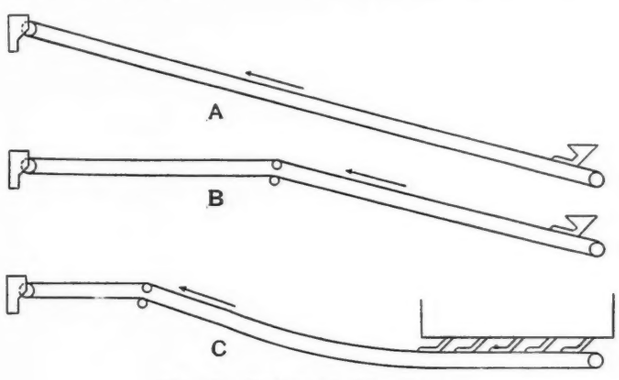


Fig. 2—Styles of Conveyors.

speed as the belts, and the higher the speed the more the slip at the loading point and the greater the wear at the belt.

Fig. 2 B is the combination of an inclined and level conveyor.

Fig. 2 C illustrates the combination of a curved and level conveyor. The radius of the curve depends on the size of the belt, location of the drive and local conditions. From 200 to 250 ft. radius is usually safe on belts of the wider sizes.

Fig. 3 A shows a combination of level conveyor, fixed dump, inclined conveyor and a series of fixed trippers.

Fig. 3 B shows a conveyor starting level, carrying material down hill on an incline and curve, up hill and then level.

These diagrams show the extreme flexibility of this appa-

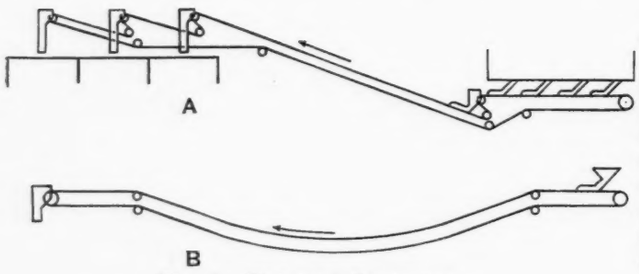


Fig. 3—Styles of Conveyors.

ratus. It may be laid on the surface of the ground without being leveled other than may be necessary to prevent sharp bends in the belt.

SUPPORTING STRUCTURE.

Fig. 4 shows a typical cross-section of a belt conveyor. The structure consists of two stringers extending the full length of the conveyor. The planks of the troughing idlers are spiked on top and the spaces between the planks are covered with a dirt-tight decking of matched boards to prevent material from falling through to the return belt. The clamp

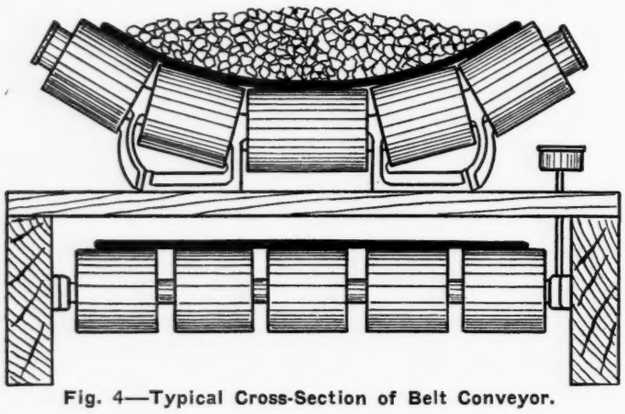


Fig. 4—Typical Cross-Section of Belt Conveyor.

boxes of the return idlers are bolted to the inner side of the stringers, the grease cup being placed above the decking.

When the conveyors are close to the ground they may be blocked up with timbers placed under the stringers. When they are elevated the stringers rest on the caps of the bents. When the span is great the stringers may be trussed.

In cases where the conveyors must be moved frequently they may be made up in portable sections as illustrated in Fig. 5.

On one end section is placed the driving pulley with its gears and motor, or the motor may be on a separate skid and belted. The other end section carries the take-ups and pulley. The intermediate sections each carry the proper number of troughing and return idlers. The sections are fastened together at their ends by bolts passing through the angle irons on the sides of the stringers. It will be noted that the bottoms of the stringers are clear and unobstructed so that the sections may be easily moved on rollers.

Portable conveyors 30 to 50 ft. in length are frequently used. In such cases the stringers are usually trusses and the motor is located between the upper and lower belt so that the structure is the same width its entire length. Eight conveyors of this type were used last year handling 35,000 cu. yds. of material in the excavation for a large building in Chicago.

EASE OF ERECTION, DISMANTLING AND TRANSPORTATION.

Owing to the simplicity of the supporting structure it may be cheaply and quickly put up. The erection of the machinery consists of setting the conveyor ends, spiking down the troughing idlers, placing the return idlers and stretching and splicing the belt.

The belt conveyor does not require the absolutely perfect alignment necessary to the operation of the chain conveyor, therefore the structure may be roughly and quickly built. When knocked down the conveyor consists of a bale of belt, the idlers, and the machinery of the conveyor ends. The pieces being small and light, they may be quickly loaded on cars and take but little room. The belt conveyor is used almost exclusively in South Africa because, for one reason, its weight is only about one-sixth that of a chain conveyor of the same capacity, thus saving largely in transportation charges and in the weight of the supporting structures.

When made up in portable sections as shown in Fig. 5, the

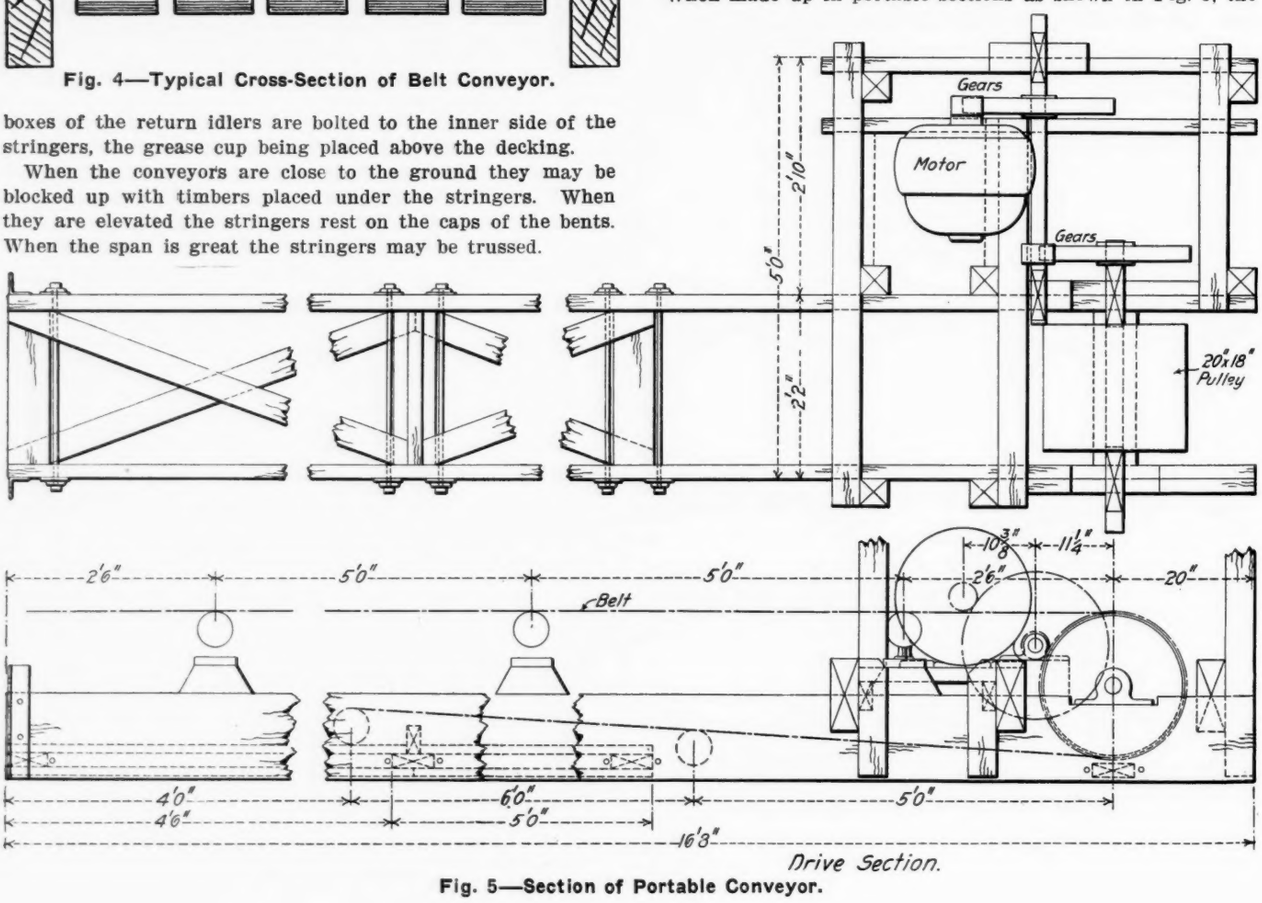


Fig. 5—Section of Portable Conveyor.

sections may be cheaply loaded onto flat cars, and quickly assembled at the new location.

FLEXIBILITY.

Figs. 1, 2 and 3 show the variety of arrangements in which the belt conveyor may be used. The fixed or movable tripper may be used on the horizontal portion of Fig. 2 B or 2 C and many other combinations are possible to suit local conditions.

If the conveyor be made up in portable sections as illustrated in Fig. 5, it may be lengthened or shortened by adding or removing the desired number of sections and splicing in or removing the proper amount of belt. This will require about the same amount of time as the placing of the same length of portable railway track, and the capacity will be much greater.

USES.

The above brief discussion of the construction and arrangement of the belt conveyor will give a general idea of the apparatus, and below will be found a list of places where this conveyor has been successfully used.

At Gravel Banks.—Elevating gravel to the screens; stacking the rejections; loading cars with gravel.

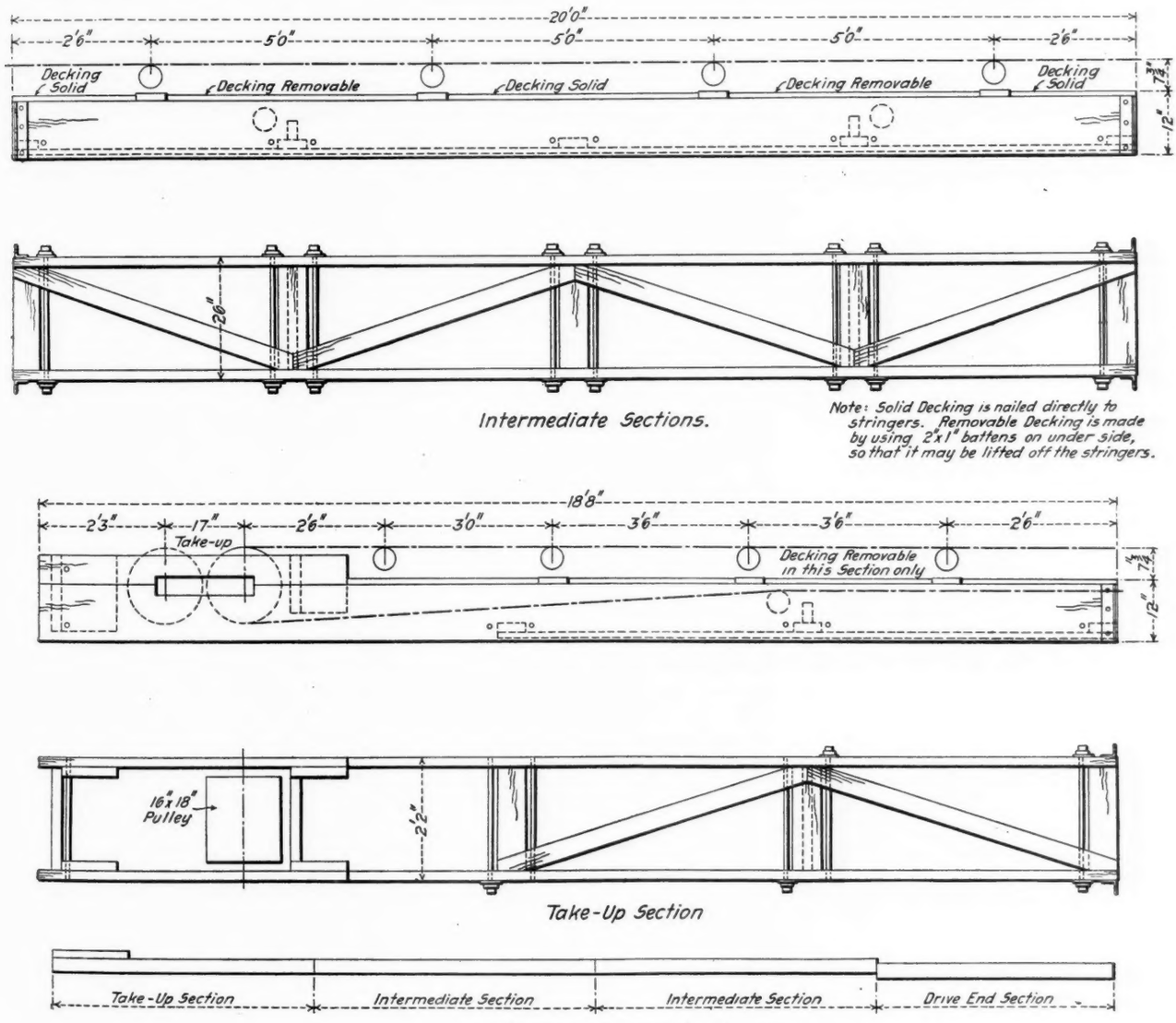
In Stone Crushing Plants.—Elevating stone to the crushers; elevating crushed stone to screens; conveying crushed stone to storage bins; conveying crushed stone from bins to cars.

In Excavations.—Stacking material from steam shovel; conveying material out of cut and stacking it on sides of bank; conveying material back of shovel and loading train of cars by means of a tripper.

In Concrete Making.—Conveying stone, sand and bags of cement from cars to storage bins; conveying stone, sand and cement from bins to mixer; conveying mixed concrete from mixers to forms.

In many cases where large quantities of earth and rock are being handled the belt conveyor adapts itself very well to the work, as it may be run on an incline of 20 deg. and requires a very light trestle for support. The conveyor may be quickly erected and as quickly removed. The same conveyor may later be used in handling concrete material and mixed concrete. In fact, each job suggests new uses for the apparatus, owing to its extreme flexibility.

Some years ago the writer, with great difficulty, induced a large contractor to use a 30-in. belt conveyor for handling material in the excavation for a large building. The ground was plowed up and both the earth and rock were moved to the conveyor by wheeled scrapers. After the excavation was completed the conveyor was used to carry concrete materials from bins to mixers. This same conveyor has been used on 15 to 20 contracts within the past eight years and several other conveyors have been added to his equipment.



Take-Up Section

Diagram of Complete Conveyor

Fig. 5 (a).—Sections of Portable Conveyor.

A PRACTICAL MACHINE TOOL SYSTEM FOR A RAILWAY SHOP.

BY W. J. EDDY,
General Tool Inspector, Erie Railroad.

In this day of specialization and of successful introduction of the piece-work, bonus and individual effort systems in railway shops, to secure a maximum output of the machines with the expenditure of as little power as possible, it is necessary to have all machine tools for cutting metals ground to the correct angles of clearance, top and side rake, etc. These angles have been tested so thoroughly by F. W. Taylor, and reported in the proceedings of the American Society of Mechanical Engineers, that it is unnecessary to touch upon them here. However, it has been proved beyond a doubt that machine tools ground to certain angles of clearance, etc., will give the greatest output with the least resistance.

It is useless to suppose that these angles will be maintained by the different individual workmen in a machine shop, as each has his own ideas as to the best angle and shape to which a tool should be ground. As a result of an investigation conducted by the writer, it developed that no two men in the shop would grind tools to the same angle for performing the same operation, which resulted in more or less unnecessary time being consumed by one or the other.

In order that correct schedules of work done could be made out which would be as fair for one as for another, and that each would have similar tools ground to the same angles for the same operations, a system of grinding machine tools to the correct angles was established. This system consists of having all tools ground on a machine in the tool room. A supply of these tools is kept in stock and they are checked out to the operators. In order to reduce as far as possible the different sizes of tool steel used, each machine in the shop was checked up and in some cases the tool posts changed to use the standard sizes of tool steel. The number of different sizes of steel used was reduced from 16 to 10.

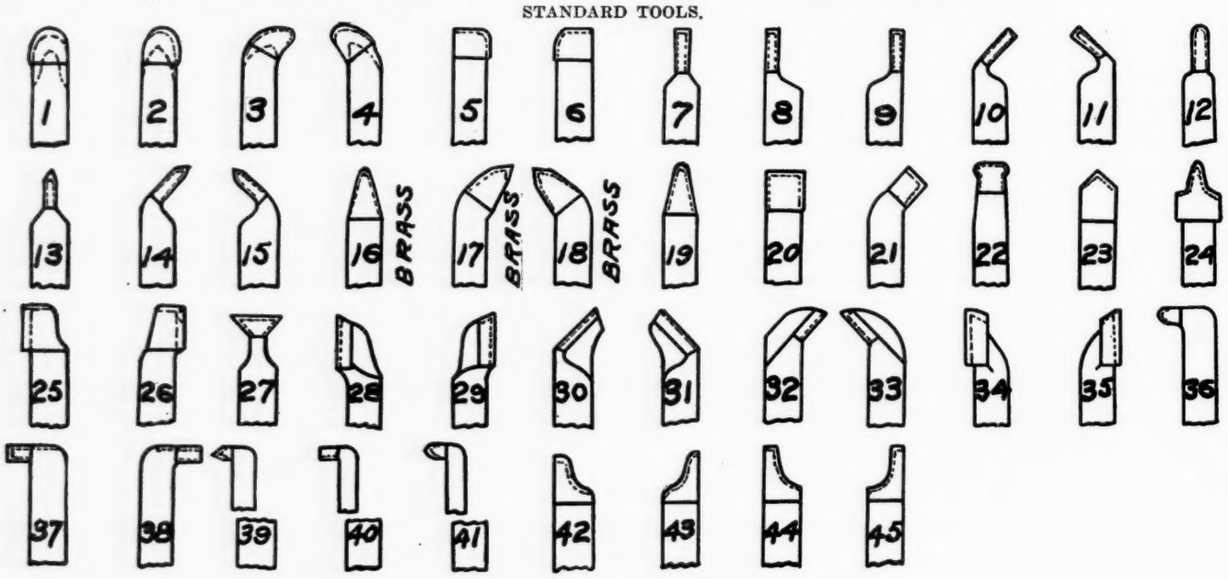
A machine tool chart was prepared to provide suitable data by which a machine operator could intelligently order tools. These charts, one placed at each machine, are mounted on sheets of tin and the face of the print varnished to facilitate cleaning. The chart gives a simple plan outline of 45 standard tools, numbered regardless of the different sizes of steel.

The letters A, B, C, etc., were given to the different sizes of steel. Opposite these letters the numbers of the several machines using the particular sizes of steel are given. The machine operator determines from the chart the tools which are necessary for any operation. For instance, if his machine uses ⅝-in. x 1¼-in. steel, which is designated by the letter A, and the particular work requires numbers 3, 10 and 14, he obtains from the tool room, L, 3, 10 and 14, A tools. The tool room attendant knows by these symbols that the operator is running a lathe and wants tools 3, 10 and 14, of size

Size of Steel.		*Nos. of Machines Using Size of Steel.*
⅝ in. x 1¼ in.	A	6—8—11—12—14—33—34—45—46—55—205—212.
¾ " x 1½ "	B	4—5—43—44—56—57—202—203—218.
¾ " x 1¾ "	C	16—32—36—200—201—209—217.
½ " x 1 "	D	13—17.
1¼ " x 2 "	E	2—3 Journal and Truck Wheel Tire Lathe.

Size of Steel.		*Nos. of Machines Using Size of Steel.*
1½ in. x 2¼ in.	F	1 Driving Wheel Tire Lathe.
¾ " x ¾ "	G	38—49 Horizontal Boring Mills.
1 " x 1 "	H	50—51 Vertical Boring Mills.
1¼ " x 1¼ "	I	31 Vertical Boring Mills.
1 " x 2 "	K	216 48-in. Planer.

STANDARD TOOLS.



Symbols for Ordering Tools.

L I A = Lathe Tool No. 1 ⅝-in. x 1¼-in. Steel.
P 2 C = Planer Tool No. 2, ¾-in. x 1¾-in. Steel.
B 3 H = Boring Mill Tool No. 3, 1-in. x 1-in. Steel.
S 5 A = Sharper Tool No. 5, ⅝-in. x 1¼-in. Steel.

Machine Tool Chart; Erie Railroad.

⅝-in. x 1¼-in. steel. The same tools are kept in stock ground for boring mill, planer and shaper work. The machine tool rack in the tool room is so sectioned and marked as to make it comparatively easy and simple to obtain any of the 45 standard tools, ground for use on either a lathe, planer, boring mill or shaper.

After a close study of the work done in the shop, it was decided that the 45 tools shown on the chart were all the standard tools necessary. If, however, a special tool is required, it may be made by securing a written order from the machine foreman.

A chart showing the method of grinding each of the different standard tools and giving the correct angle for either lathe, planer, shaper or boring mill tools has also been prepared. This chart is kept at the grinding machines. A direct saving of 45 per cent. was effected in one year through the use of this system. An indirect saving is shown by the increased output of machines, due to sharp tools ground to the most efficient angles.

THE TELEPHONE IN TRAIN DESPATCHING.*

It will be contended by many that the telegraph operator does his work unconsciously and is therefore not subject to a mental strain. But despatchers and operators who have been using the telephone for despatching work, in nearly every case speak of the reduced strain. They can do the same amount of work by telephone in one-half of the time formerly required. The abandonment of the telegraph key for calling the stations has been a great physical relief to the despatchers, and the operators have been relieved of all calling of the despatcher. The stations answer the signal given by the selector bell much more promptly than they do the sounder. The fact that the noise of the telegraph instruments is removed will also have an effect upon the work of the despatchers and operators.

The calling of stations by the despatcher while conversation is being carried on with other stations saves time. There is greater accuracy in transmitting orders by telephone as the despatcher writes down each word as it is spoken instead of sending it from memory by telegraph. The improved line construction and telephone apparatus available to-day is far superior to that used even five years ago. It has been stated that all voices are not transmitted equally well by telephone. This is true, but trouble from this cause is seldom experienced and it will be possible to obtain employees with suitable voices easier than it is to get employees who can send good Morse. The telegraph operator is subject to paralysis of the arm. There is no such effect or any other physical trouble caused by the continued use of the telephone, and its introduction enables many telegraph operators already affected with paralysis, but otherwise efficient employees, to continue to carry on their work in a satisfactory manner.

The despatchers and the operators have become better acquainted since using the telephone and this has resulted in closer co-operation in the performance of their work. The fact that they are talking with each other seems to have eliminated the caustic remarks and comments so frequently sent by telegraph. The remark of a despatcher after using the telephone for several months to the effect that he "had not been mad once since using the telephone" is well worth repeating, as it indicates an improved condition. By equipping trains with portable telephone sets the despatcher may be reached from any point between stations in case of breakdown.

The first of the present type of telephone despatching circuits was installed by the New York Central in October, 1907, between Albany and Fonda, 40 miles. The Chicago, Burlington & Quincy was the next, in December, 1907, Aurora to Mendota, 46 miles. At the present there are over twenty telephone despatching circuits in use on the C. B. & Q., covering 1,534 miles of road (1,381 miles single track).

The construction of the line is important. Hard drawn copper wire of sufficient size to withstand wind and sleet should be used and the line should be a metallic circuit, i.e., two wires should be used. The wires forming the circuit should be properly transposed and so located in relation to other circuits as to prevent inductive disturbance from other wires or mechanical injury. The introduction of considerable amounts of cable in the circuits should be avoided as it reduces the volume and affects articulation. When cable must be used, lead covered paper insulated telephone cable having the wires twisted in pairs to prevent inductive disturbances should be used, not only on account of it affecting the transmission less than the rubber insulated cable, but also on account of its lower first cost. Cable of this type can be furnished to withstand the potentials used on telegraph circuits and on account of its low capacity, as compared with rubber insulation, will improve the operation of telegraph service as well as that of the telephone circuits. Adjacent telegraph or telephone circuits, if used in emergency as patch circuits, should be in first-class condition. Copper wire weighing 210 lbs. per mile usually has been used. This is of sufficient size to render a very high grade of telephone transmission. With from 35 to 50 poles per mile a circuit of this kind will, with few exceptions, withstand severe wind and sleet storms.

Circuits like those now being used will cost $85 per mile or a division of 150 miles $13,000. These figures do not include the telephones and selective apparatus, the prices of which vary according to the type used. The average life of the copper wire is considered to be fifty years. By applying suitable apparatus to two telegraph wires two duplex telegraph circuits and one metallic telephone circuit may be obtained which will permit of four telegraph messages and one telephone message being transmitted simultaneously. Such a circuit as this has been in use on the Union Pacific between Omaha and Cheyenne since last June and has been rendering excellent service. When the telephone circuit is not being used for official conversations between division headquarters, it is used for the transmission of messages which otherwise would be sent by telegraph. The following traffic was handled over this circuit in a month:

Messages by telegraph	59,020
Messages by telephone	30,703
Conversations by telephone, 2,539; time consumed by conversations, 126 hrs., which is equivalent in messages to	3,780
Total	93,503

The telephone messages are handled at a less expense than by telegraph. The telephone operators handle as high as 450 messages a day and this could be increased if the line were not used so much for conversations.

For train despatching service due consideration must be given to the length of the line, the kind and size of wire, the number of stations connected to the line, the kind of telephone, transmitter, receiver, induction coil and circuit, together with the kind and amount of current supplied. The number of stations connected to lines now in service varies from ten to forty-four. In regular commercial telephone service there are usually but two people talking or listening on the line at a time, while in despatching service it is customary to have from three to five operators in addition to the despatcher all connected to the line at the same time and in addition an unknown number of other stations listening to their conversation. Various methods of rendering efficient service under these severe conditions have been proposed and tried. Some have attempted to equalize the telephonic current passing through the receivers at the various stations, others have increased the volume of transmission, and still others by a combination of the two have attempted to secure more satisfactory results. In some cases increased volume of transmission has been accomplished at an increase in battery consumption and a decrease in the clearness of articulation. In others the volume of transmission has been decreased to obtain clearer articulation. The great difficulty is that there is no standard. No two users of a telephone will agree as to the relative volume of articulation obtained on two different circuits. Even with skilled observers differences in volume of transmission are often taken for differences in quality of articulation and vice versa, or the amount of difference when judged in per cent. will vary within a wide range. A comparison of a laboratory standard and a working line is a physical impossibility if the tests are to be made by the same parties and under the same conditions. Comparisons made by observing the service on one line and then several days later observing the service on the same or a different line cannot be considered fair. Further, changes in atmospheric or physical conditions may occur in an instant.

The limit of commercial transmission is taken as that obtained over a 1,000 mile circuit of No. 8 BWG copper using standard telephone sets and circuits. It is, of course, impossible to make tests over an actual line of this kind, so

*From a paper read before the St. Louis Railway Club, by W. E. Harkness, Engineer Western Electric Co., New York.

artificial lines have been constructed and comparisons are made with these as a basis. To reduce the chances of error still further these artificial lines have been compared with standard No. 19 gage paper insulated telephone cable and reduced to terms of miles of No. 19 gage cable. This establishes a unit of comparison, and all comparisons are expressed in these units. In this way, it has been determined that transmission over 1,000 miles of No. 8 BWG copper circuit is equivalent to that obtained through 30 miles of standard No. 19 gage paper insulated cable. * * * Numerous attempts have been made to measure the relative transmission obtained from telephone instruments, but no instrument has yet been devised which will distinguish between good and bad articulation as accurately as the human ear. For a number of months work has been carried on with the idea of developing apparatus which will transmit with sufficient volume and clear articulation and at a minimum consumption of battery to satisfy the most critical. It is expected that this apparatus will be available for use within a short time.

Various types of telephone sets are being used at the stations. The New York Central and the Canadian Pacific are using a special transmitter arm so arranged that the transmitter and receiver are fixed on the arm, and the operator upon placing his ear to the receiver has his mouth in line with the transmitter. This arrangement permits an operator to have the use of both hands. A foot switch is used to close the transmitter battery. This is used to prevent a waste of battery and the introduction of noise on the line when an operator is listening on the circuit. The Burlington and a number of other roads have been using a simple form of transmitter with which a head telephone is used, thus giving the operator considerable freedom of movement. The telephone equipment is connected to the circuit by moving the head telephone from a switch hook upon which it is hung when not in use.

A key operated by hand is provided to close the transmitter battery during conversation. This key is arranged to open the transmitter circuit when released by the operator, thus permitting him to listen on the circuit without a waste of battery or causing a noise on the circuit. A foot switch could be used with this equipment if desired. The use of the transmitter key has not been found objectionable as it is not necessary to hold the key when receiving, thus having both hands free for writing. When talking the operator is not required to write so there is no necessity for him to have both hands free. With this apparatus the operator is not compelled to speak directly into the transmitter, but this apparently has not caused serious trouble.

The desk stand arranged for a head telephone has also been used, principally on account of its low price. On the D. L. & W. this is now standard. It is liable to injury by being knocked off the desk, but has the advantage of being located so as to be convenient to several people.

The Santa Fe and Union Pacific have used a set between the transmitter arm and the desk stand or what is commonly called a "flexiphone." This consists of a desk stand stem attached to an arm which can be raised or lowered so that it can be used while seated or standing and in addition can be rotated in a horizontal plane. The despatcher's equipment is practically the same on all of the railroads and consists of a chest transmitter, supported by a band passing around the despatcher's neck, and a head telephone.

It has been suggested that a loud speaking receiver be used by the despatcher. This arrangement while available and capable of giving a large volume of sound is not satisfactory on account of the quality of the sound rendered being less distinct than that obtained from a regular receiver held close to the ear. This is largely due to the reflection of the sound waves in the horn which must be used to amplify the sound. Another objection to this device is that noise in the room or from outside will prevent the despatcher hearing distinctly. A device of this kind is to be tried on one of the eastern roads for use in block towers in connection with the reporting of trains from tower to tower. Another design is being prepared for one of the western roads for trial on a despatching circuit. The use of a double head telephone has been considered and should be of benefit where the despatchers or operators are located in noisy locations. The use of a transmitter which could be mounted on the despatcher's desk which could be spoken to in place of having to speak directly into the mouthpiece as at present has also been suggested. This arrangement, while possible, would be found unsatisfactory for two reasons. First: It would render a poor quality of transmission, and second: it would necessarily have to be very sensitive to transmit the voice from a distance and it would therefore pick up other sounds in the room which, when transmitted on the circuit, would affect the service.

The cost of the telephone apparatus depends largely upon the type used and will vary from $17 to $36 per station. An average of $25 per station may be used for rough estimates. The selective apparatus in general use may be divided into two classes, electromechanical and mechanical, the Gill representing the electromechanical type and the Wray-Cummings the mechanical.*

The selector when operated closes a bell circuit and causes the bell at the station to ring until stopped by the operator answering the call. Where the bell at a station rings continuously until the call is answered and a station is called by mistake and the call is not answered for hours owing to the absence of the operator, there is a waste of battery, and one arrangement permits the despatcher to stop the ringing of the bell at any time after it has started. Another arrangement permits the bell to ring for a certain length of time and then automatically causes it to cease. One of the selective systems has what is known as an "Answer-back," an audible signal received by the despatcher when he has called a station and the bell has started to ring.

The cost of the total station equipment, including telephones, selectors, test panels and installation will vary according to the apparatus used from $60 to $96 per station. Combining these figures with those covering the cost of the despatcher's equipment and the line construction a despatching circuit of 150 miles, to which is connected 30 stations, will cost approximately $15,000, or at the rate of $100 per mile.

W. W. Ryder (C. B. & Q.): The telephone has been used by us fifteen months. During this time the service has been watched very closely and with increasing satisfaction.

That there may be no misunderstanding of orders given by the despatcher over the telephone, due perchance to haste, it is the custom to have the despatcher copy the order in his order book as he talks it off, thus gaging or reducing his rate of speech to his ability to write it down, and to the ability also of the receiving operators to make their copies; but even this speed is greater than that obtainable by the telegraph.

Each operator is compelled to repeat his order word for word to the despatcher, and also to listen to each of the other operators receiving the order while they in turn make their repetitions. The operators in repeating are allowed to read as rapidly as is intelligible, or at a rate far in excess of what they could make on the telegraph key, thereby saving much time for themselves as well as the listening despatcher. All names of stations, where given as meeting points in an order, and all figures are spelled out letter by letter both in the transmission of the original order and in all repetitions.

While a call is being made the circuit can be used at the same time for conversation, and during even the short time elapsing between the call and response oftentimes several offices will cut in and report trains or give the despatcher other information. These various savings in time—never at the expense of accuracy—greatly aid the despatchers in keep-

*The Wray-Cummings apparatus was described in the *Railroad Age Gazette* February 19, page 359.

ing their train sheets up-to-date and this condition is secured with much less physical effort.

Equally serviceable is the telephone in handling way office communications other than train orders, including Western Union messages, and here the question of quickened service is still more noticeable. Actual experience demonstrates the fact that it is possible to handle a much greater volume of business to and from the way offices by telephone. In one case where more attention has been paid to this feature than elsewhere the increase regularly amounts to more than 75 per cent.

The telephone works even better in bad weather than in good. The lower the static capacity of a telephone line the more satisfactory the service, and damp weather tends to reduce this static capacity. Then, too, adverse weather conditions such as frequently make the telegraph absolutely unusable, have no effect on the adjustment of the telephone. It stands ready for immediate use in all kinds of weather.

There is hardly a town anywhere on the line in which there are not bright young men who with the proper training would be perfectly competent to act as telephone operators, and this without the considerable study necessary to pick up the art of telegraphy. And it is far better policy to make use of men in their home towns or who have grown up along the line, as they usually have a local pride or interest in the success of their work. Our telegraph service was at its best when this condition existed to a considerable extent, and personal interest and discipline have lessened in proportion as we have been compelled to import telegraph talent. Now the use of the telephone is enabling us to return to the basis above outlined with resulting improvement.

The initial cost of a telephone circuit is greater than that of a telegraph circuit, and the maintenance expense will probably be somewhat greater, but the benefits derived from the change more than offset the increased expense.

NEW RAILWAY LAWS IN INDIANA.

The legislature of Indiana, recently adjourned, passed seven general laws affecting railways and three affecting electric lines. These latter deal with matters which are chiefly of local interest; interurban lines are given additional authority in connection with the purchase of equipment; toll road companies are authorized, under certain conditions, to grant rights of way to interurban or street railways, and a third bill regulates the making of contracts between railways and street railways.

Of the bills affecting railways generally, the most radical are those concerning headlights, bells and ash pans. Senate Bill No. 44 directs the railway commission to investigate locomotive headlights and authorizes it to enforce compliance with its orders by the railway companies. This bill was a substitute for others which had been introduced to compel the use of electric arc lights. House Bill No. 60 requires automatic bell ringers after January 1, 1910, on all locomotives, under penalty of a fine of from $100 to $300. Senate Bill No. 293 requires, after the first of January next, on all locomotives, ash pans which can be emptied without the man going under the engine—penalty $200 to $400. This is similar to the federal law on the same subject.

House Bill No. 379 requires all passenger and freight trains to be equipped with medical emergency boxes. House Bill No. 39 authorizes the railways to charge 10 cents additional fare when a passenger pays on the train, and the requirement that this excess shall be refunded is rescinded. The bill declares it unlawful for any person to ride as a passenger on any railway without payment, on demand, of the cash fare or ticket fare prescribed by law. Senate Bill No. 31 requires that after January 1, next, every switching engine shall be uniformly equipped with front and rear foot boards; and with grab irons. The law specifies the height and other particulars; penalty $100.

House Bill No. 274 re-enacts the law of 1907, regulating train crews. It requires that all flagmen shall have had at least one year's experience in train service, and the brakeman or flagman of a train shall not be required to act as porter.

RAILWAY SIGNAL ASSOCIATION.

The Railway Signal Association held its regular March meeting at Chicago on Monday, the fifteenth, President L. R. Clausen in the chair. In the forenoon the members listened to a paper by Mr. Creighton, of the General Electric Company, on lightning. Mr. Creighton illustrated his address by the use of high potential discharge apparatus, consisting of Leyden jars and transformers. It is very difficult to obtain definite data on lightning, as to the true potential or the amount of current or the frequency of discharge, and hence it is difficult to design an efficient arrester. However, recent laboratory experiments indicate that the average current of a lightning discharge is ten thousuand amperes; this is a direct stroke. But direct strokes seldom interfere with signal circuits, owing to the shortness of these circuits. Mr. Creighton explained briefly the present ionization theory of lightning, and described various kinds of discharges. Arcs following lightning discharges are due wholly to vaporization of the electrodes and cannot be maintained in air. Forty volts is the minimum potential necessary to maintain an arc. Lightning arresters successful in laboratory have proved useless in actual working, because working conditions cannot be produced artificially. No single test will show the value of an arrester. The frequency of lightning varies between a half million and a million cycles per second. Mr. Creighton performed experiments showing the behavior of choke coil arrestors. He showed that a discharge tends to leak from coil to coil. He also experimented with other varieties of arresters to test their efficiency. Arresters should be close to the apparatus to be protected and the connection to the ground should be short. The best ground connection consists of several ordinary iron gas pipe sections, driven down three to five feet, six feet apart. In dry ground salt will increase conductivity and will last several years.

In the afternoon there was a debate on the question, Resolved, that the scheme of signal practice, presented at the annual meeting at Washington last October, is the best devised to date. The first speaker was W. H. Elliott, of the New York Central. He explained by diagrams the main features of the scheme (diagram shown in *Railroad Age Gazette*, October 23, 1908). He declared the system to be a logical development of the best present practice; the upper quadrant and double light features being introduced as additional safeguards. The first speaker on the negative side was Thomas S. Stevens, of the Atchison, Topeka & Santa Fe, who presented another scheme of signaling based on having two arms on every post, the upper arm always giving home-signal information and the lower always distant signal information. (See committee report of A. R. E. & M. W. Association, *Railroad Age Gazette*, March 19, page 586.)

Mr. Stevens declared that the system presented at Washington was too much at variance with present practice and with the recommendations of the American Railway Association. Also it was not thoroughly consistent, especially in regard to aspect No. 9. Mr. Anthony, of the Pennsylvania, for the affirmative, rejoined with a general defense of the system presented at Washington, and pointed out inconsistencies in Mr. Stevens' scheme. Mr. Clausen, for the negative, presented a third scheme, the fundamental feature of which is a signal having only one arm. In other words, he proposes to adapt the present system of three-position signaling to all requirements, using the upper quadrant indications. He defended this as the simplest and most easily understood system possible to

devise. He attacked the system presented at Washington chiefly on the ground of complication and the use of unnecessary indications. After the four principal speakers got through there was general discussion until after six o'clock, when the chief debaters presented their concluding arguments. A vote was then taken and resulted in a victory for the negative side; affirmative vote 33, negative 79.

The secretary announced the recent death of Harry C. Hope, of St. Paul, formerly president of the association, and appropriate resolutions were passed.

ABUSE OF THE M. C. B. REPAIR CARD.*

BY EUGENE CHAMBERLAIN,
Chairman Freight Car Repair Pool, N. Y. Cent. & Hudson River R.R.

Current M. C. B. rule 76 requires that when repairs of any kind are made to foreign cars, a repair card shall be securely attached to designate locations of the repairs, this card to specify fully the repairs made, reasons for same, date and place same were made and name of road making the repairs, etc. Obviously, the repair card was adopted for the purpose of establishing a close relationship between the car owner and the road making repairs and thus eliminate tracing upon the part of the car owner to determine the responsibility in the event of wrong repairs having been made, and at the same time relieve intermediate or delivering roads from any responsibility.

The object was most worthy, and if all roads actually making repairs to foreign cars fully complied with rule 76, identification by owners would be easy, and prompt adjustment in the event of wrong repairs possible. Unfortunately, however, it is claimed that rule 76 is not being complied with by all railway companies who are parties to the M. C. B. rules, thus producing a very unsatisfactory condition and practically annulling the purpose for which the repair card was created. It has been discovered on some roads that the card is often attached to cars by attempting to force the tacks into the timber with the thumb, with unsatisfactory results. When the car finally reaches home, minus the card, and it is found that wrong repairs have been made, the owner must pay the cost of repairs or employ an additional force of clerks to trace and locate the malefactor. The length of time required for the car to reach home is often great, and the stubs that have accumulated with the bills from foreign roads reach such proportions that the function of selecting the particular stub to check against the card on a car requires time and patience not usually allotted to the busy railway man. If you are fortunate enough to finally locate the stub for the car in question, and upon examination of the car discover that the metal parts are so corroded or tarnished that you are unable to distinguish between alleged new work and the old, one is apt to give the billing road the benefit of the doubt and pass the bill for payment; also in cases where you are in receipt of a bill for repairs and the car itself bears no repair card or evidence of the work described, you still have left the choice of two evils, that of passing the bill without finally locating the work, or refusing payment.

While unquestionably rule 76 has been and is to-day being flagrantly violated, one would be without standing in court should he without positive proof allege dishonesty upon the part of any railway in the non-application of repair cards. It is possible that the fault may lie in the indifference of repair men. The fact remains that bills are being rendered for repairs to cars that bear no repair card, and in some instances no evidence of repairs having been made. In the light of experience, it would appear that the repair card in its present form is not what it should be, and even if rule 76 be fully and honestly complied with by all roads, the weakness still remains and is about equally divided between the possible loss when attached or failure to attach the repair card to the car, and the difficulty of determining by examination of the car whether specific repairs have or have not been made, especially when cars are long absent from home.

Assuming that all roads are, or intend to be, perfectly honest in complying with rule 76, what in the rule will prevent a road from removing a pair of wheels in perfectly good condition, that have been in service but a year under a foreign car, and placing this pair of wheels for further service under one of its own cars, and billing the foreign road for a pair of new wheels to replace those which it claims were shelled out, and attach a repair card to the car in evidence of work done? Again, what in rule 76 will prevent any road taking the initials and numbers of any and all foreign euipment which may be standing upon their sidings in perfectly good condition, attaching repair cards thereto without doing any work at all and rendering bills for alleged repairs? It is rumored that a certain railway established the practice of applying side doors to the majority of foreign cars passing one repair point, brake-shoes at another repair point, air-brake hose at another, etc. This scheme worked well until the side door specialist became over zealous and began to apply side doors to coal cars, which fact the car owners discovered when about to pass the bill. Whether this be true or not, the possibilities are certainly present.

It has been suggested that many so-called combination car users' defects, as described in M. C. B. rules 49 and 56, are somewhat dangerous for the car owner, in view of the fact that they can be speedily converted into the owners' defect by a slight error on the part of a repair man in omitting to repair the end sill, where both that and a longitudinal member are damaged and require replacement on the same end of a car. The loss of the repair card takes from the car owner the only means of identifying the actual repairs made. Should the owners, upon examination of the car, discover that a new end sill had been applied in conjunction with the longitudinal sill, they would doubtless refuse payment for the latter. These queries are simply submitted as food for thought and are in no wise intended to convey the idea that any railway in the country would adopt any other than fair and honest measures; but I am reminded that any rule which would make absolutely impossible nefarious practice would be an excellent one to adopt as a substitute for present rule 76.

It is human nature to criticise or pick flaws in any rules provided for the government of men or business, and I am only one of the great army that comes before you without a remedy which practice has proven faultless. The remedy will come in due time through the united effort, thought and action of the railway men of this country, to whom I bare my head in recognition of their unquestioned fairness and honesty of purpose. In the meantime, and still operating under the present rule 76, let us aim to obey it to the letter and if necessary establish an inspection that will leave no doubt in our minds that the provisions of the rule are being absolutely complied with on the road we are representing.

*From a paper read before the New York Railroad Club, March 19, 1909.

A society of automobilists in England asked the Board of Trade not to permit a proposed local railway to be built unless it would eliminate some crossings of highways at grade shown on its plans. The impertinent Board of Trade replied that in the whole United Kingdom in 1907 50 persons were killed and 30 injured by trains at railway crossings—many of them attempting suicide, and most of them by their own fault; while in the city of London alone in nine months of that year 105 persons were killed and 2,945 injured by automobiles; which was the Board of Trade's way of saying that the motor-car people should take the beam out of their own eye before asking the railways to take the mote out of their eye.

General News Section.

The Federal Board of Mediation, Messrs. Knapp and Neill, have informed the firemen of the Pennsylvania Railroad that the grievances submitted by the firemen do not constitute a ground for action by the Board.

William Barclay Parsons, who a few years ago held the position of Advisory Engineer to the Royal Commission on London Traffic, is now to make a study of the London transportation problem, in so far as it affects the Underground Electric of London.

The inspectors of the Bureau of Explosives connected with the American Railway Association have lately discovered explosives in the baggage of passengers, in a few cases, and one passenger, a miner, and presumably ignorant of the requirements of the law, has been arrested and held for trial.

Robert Thurston Kent has resigned as Engineering Editor of the *Iron Trade Review*, Cleveland Ohio, to become Managing Editor of *Industrial Engineering*, Pittsburgh, Pa., a new paper devoted to mechanical engineering. Mr. Kent has been with the *Iron Trade Review* since 1905, and prior to that time was Associate Editor of the *Electrical Review*, New York.

A committee composed of two representatives of each railway entering Chicago has been appointed to complete plans for the organization of a club, to be called the Chicago Railway Club. W. B. Barr, General Freight and Passenger Agent of the Chicago Terminal Transfer, is Chairman of the committee, and E. L. Bevington, Secretary of the Transcontinental Passenger Association, is Secretary.

The Managers of the Alaska-Yukon-Pacific Exposition, to be held at Seattle beginning June 1, announce that the transportation building will before long be ready for the exhibits. The major portion of the cost of this building was provided by eastern locomotive builders. It is promised that the exhibits of locomotives and cars, and also all kinds of equipment for electric roads, will be on a liberal scale.

At the Windsor street station in Montreal, March 17, four persons were killed by a runaway train, which, after running uncontrolled for about five miles crashed into the station at high speed. About a dozen other persons were injured, some of them fatally. The train became uncontrollable because of the blowing out of a plug on the engine, which allowed the cab to be filled with steam. The engineman and fireman jumped off and the other men of the train were unable to stop it.

The New York Public Service Commission, First district, has begun proceedings to collect from the Brooklyn Heights Railroad a fine for disregarding an order of the commission requiring the road to run a certain number of cars over the Williamsburg bridge between New York and Brooklyn. The commission ordered the company to run, during the rush hours, 24 local cars every 30 minutes; but the company, after obeying the order for a time, reduced the number of cars to 14 each 30 minutes.

Daniel Willard, Vice-President of the Chicago, Burlington & Quincy, made an argument March 17 before the committee on railways of the Illinois Senate against various bills for the regulation of railways that are pending. The bills in question provided, among other things, against liability contracts between employers and employees, against extortion and unjust discrimination by railways, for "full crews" on various kinds of trains, for foot boards on switching locomotives, etc. Mr. Willard estimated that the bills now pending in the two houses of the Illinois legislature would, if passed, cost his road alone $210,000 a year. The bill against liability contracts between employers and employees would break up the pension system which the Burlington established in 1888 and under which 24,000 employees are now insured death benefits amounting to $21,000,000. This company, he said, would, if the proposed legislation were passed, save $80,000 a year in the expense of administering this fund, but where would the men get such good insurance for 6 cents a day? The bill against discrimination contained provisions which would cost his road from $100,000 to $110,000 a year, and he suggested that the matters which it deals with would be better left to the State Railroad Commission and the Interstate Commerce Commission. The bill requiring a minimum crew of five men on switching engines would cost his road $12,000 a year. It was backed by union labor probably because it would make more jobs. The bill for crews of certain sizes on pasenger and freight trains would cost his road $82,000 a year. With regard to the bill for foot boards on switching engines, he said that, with the proposed law, a cattle train halted in a yard where there happened to be no switch engine might be greatly delayed because the road would be unable to press into service a road engine for switching. He mentioned cattle trains because the Burlington hauls 188,000 carloads of stock a year. The federal law for a nine-hour day for telegraphers is costing the Burlington system $70,000 a year more than it formerly paid for this service. The Board of Directors of the Burlington had recently approved the expenditure of $12,000,000 for additions and improvements, and he was sure would go ahead with them if there should be no more unfavorable railway legislation. In Illinois alone it was intended to begin improvements amounting to from $3,500,000 to $4,000,000 within the next 60 days. If, however, restrictive and burdensome legislation was to continue, these improvements were sure to be interfered with or prevented.

Lehigh Valley Freight Piers at Jersey City Damaged by Fire.

A fire on March 19, which originated on the 600-ft. freight pier B, of the Lehigh Valley at Jersey City, N. J., destroyed that pier and damaged the river end of Pier C, and also a barge loaded with cotton. There were about 60 carloads of freight piled on piers B and C, and 60 freight cars partially loaded, standing on the tracks along the two piers. All of the cars were removed except one loaded car, which was destroyed. The loss to buildings is estimated at between $80,000 and $100,000, and freight about $50,000.

Vote of Thanks for Secretary Fritch.

The excellent work of the committees of the Maintenance of Way Association for this year's convention has been already mentioned. Not less commendable is the work of editing the reports, filled as they are with illustrations and data varying widely in character. Everybody acquainted with the facts will indorse the resolution passed at the close of the convention, that—"the association appreciates the splendid services which Mr. Fritch has rendered in filling the arduous duties of his position, and that a vote of thanks be tendered him by the association at this time."

Proposed Modifications in New York Railway Law.

Bills have been introduced in the New York state legislature to amend the Public Service commissions law by including telephone, telegraph and ferry companies under the jurisdiction of the two commissions (one for each of the two districts of the state). There are two bills. One relates to the telephone and telegraph companies, giving to the commissions power of regulation over those corporations similar to that now held over railway and street railway concerns. A second bill amends the present law generally with regard to many details. This bill not only clears up the slight ambiguity in the present law, but gives the commissions authority to order joint rates and transfers on street railways, to compel the giving of transfers between independent companies, and to regulate the issuance of transfers by any company.

Boats and vessels operated by or in connection with any

railway where both are used under a common control for continuous carriage are placed under the jurisdiction of the commissions. The commissions are authorized to prosecute an action in the name of the people to vacate the charter and the franchises of any public service corporation within their jurisdiction, in case the corporation has forfeited its privileges by failure to exercise its powers within the time prescribed by law, or where part of a franchise has not been used, to forfeit it for the same cause as to the unused portion.

The section prohibiting passes and reduced fares on railways is amended so as to permit the transportation of children under five years of age free, children under twelve years of age at half fare, and to authorize school commutation tickets at less than adult rates, and where commutation or mileage tickets are sold to prevent unreasonable discrimination as against any person or locality.

The provision relative to through routes and rates is amended to provide that the corporations shall agree as to the division of rates, or that the commissions shall have jurisdiction to determine in case of disagreement, and when the commissions think that through cars should be operated over steam railways and street railways meeting at common points they are to receive jurisdiction after a hearing to issue orders accordingly.

Changes in the provisions regarding gas and electric companies also are important. The commissions' powers of control over those corporations never were so rigid as over railways and street railways. This bill stiffens those provisions so that they are as rigid as those dealing with the railways.

In the existing law are provisions compelling corporations seeking to issue additional securities to obtain permission from the commissions, but those provisions did not include short term notes. As a result there has been a distinct tendency for transit corporations to issue twelve-month notes, refunding them by another issue of twelve-month notes, for which issue no permission was required. A provision has been inserted in this legislation prohibiting the issue of short term notes to refund similar notes.

At the request of Speaker Wadsworth and at the desire of the up-state commission, stage lines, which were put under the jurisdiction of the commissions by the proposed legislation last year, are omitted from the bills this time. The commission for the 1st District wanted them included because of the Fifth avenue stage line, but was not especially anxious about it, since that company can be regulated under the transportation corporations law.

Inspection Trip of the A. R. E. & M. W. Association.

The convention of the American Railway Engineering and Maintenance of Way Association adjourned on March 18 and on Friday morning, the 19th, a party went on an excursion to Buffington and Gary as the guests of the United States Steel Corporation. Members of the association and their friends to the number of about 550 made up the party. They left Chicago over the Lake Shore and the train was composed of ten Pullman cars arranged with tables for luncheon en route. The first stop was at the large cement plants at Buffington, Ind., 22 miles from Chicago, near Lake Michigan, and the party was here shown the methods used in making cement out of slag from the blast furnaces. The two plants here form practically one large one, but they were built at different times and are run separately. Plant No. 3 was started January 1, 1905. It contains 16 kilns, each 70 ft. x 80 ft., and has a daily output of 5,000 barrels of Universal Portland cement; and the stock house has a storage capacity of 310,000 barrels.

Plant No. 4, directly north, was started October 27, 1907, and is now in operation. This plant has 12 kilns, 75 x 120 ft., with a daily production of 6,000 barrels and storage room for 400,000 barrels. These plants are operated entirely by electric power generated by waste gases from the blast furnaces at the Illinois Steel Company, South Chicago, and transmitted by high tension alternating current, which is transformed at the plants for distribution. The raw materials used are limestone and granulated blast furnace slag.

After visiting these plants the party boarded the train and luncheon was served while running from Buffington to the Gary & Western Railway junction east of Gary, passing the sites of plants of the American Locomotive Company and the American Car & Foundry Company. The latter site occupies 210 acres, bounded on the south by the Calumet river and on the north by the Kirk yards of the Steel Corporation; and the eastern line is nearly parallel with the western boundary line of the town of Gary. Directly west of the proposed car shops is a tract of 90 acres which has been set aside for the future works of the American Bridge Company. The tract to be used by the American Locomotive Company occupies 130 acres between the Baltimore & Ohio and the Lake Shore main lines, with its east boundary near the eastern line of the corporate limits of the town of Gary.

On arrival at the Indiana steel plant the party left the Pullman train and boarded a train of flat cars for a general trip covering the whole plant, including the blast furnaces, the open hearth furnaces and the great steel rail mill. The construction of the plant was begun in March, 1906, and it commenced rolling rails the first of the present month. It has been described and illustrated in great detail by a number of the trade papers, but it may be convenient to refer to some of the principal figures relating to its capacity. The ore is taken from the lake boats by five 10-ton Hulett unloaders, with a capacity each of 250 tons an hour, and the ore bins have a capacity of 20,000 tons. The blast furnaces, eight in number, are rated at a daily capacity of 450 tons each. Three of them are now producing iron, one is ready for blast and four are under construction. The total annual capacity of the eight furnaces will be 1,200,000 tons of pig iron. These furnaces are arranged with dust catchers and gas washers, so that all of the gas is utilized either for heating the hot blast stoves or for power in gas engines. There are 16 blowing engines, each 2,000 h.p., and four 3,000 h.p., intended as spare engines for emergency. The electric power plant is located between the blowing engine house and the open hearth furnaces, and the installation consists of 17 horizontal twin tandem double-acting gas engines directly connected to 250 k.w. Allis-Chalmers generators and two General Electric Curtis turbo-generators of 2,000 k.w. capacity. Of the open hearth furnaces there are at present convenient twenty-eight 60-ton furnaces and for each open hearth furnace there are five gas producers. The rail mill and billet mill will each have a capacity of 100,000 tons a month. There is also a 60-in. universal plate mill and a 160-in. sheared plate mill. The merchant mills and axle works are now being built. The merchant mills, six in number, will have an annual capacity of 200,000 tons. The largest individual electric motors in the world are employed in these mills. The rail mill has, among others of large size, three 6,000-h.p. induction motors. The rail mill has already filled a large order for the Burlington and one for the Great Northern, and at the time of this inspection it was rolling a new 100-lb. section for the Pennsylvania Railroad.

After completing the inspection of the steel works, the party was taken to the new yard of the Chicago, Lake Shore & Eastern, where the new roundhouse, machine shop and car shops of that road were inspected; and the return to Chicago was made over the Lake Shore, reaching there at 6 o'clock.

Pennsylvania Electric Equipment.

The East Pittsburgh works of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., and the Westinghouse Machine Co. are now at work on the first apparatus represented by the $5,000,000 contract which the Pennsylvania Railroad Co. placed with the Westinghouse people some time ago for the electrification of the Pennsylvania terminals and tunnels in New Jersey, New York and Long Island. This initial contract consists of two 12,000-h.p. turbo-generator outfits, two 4,000-h.p. equipments of the same type, and one hundred 200-h.p. electric railway motors.

The turbines will be constructed in the shops of the Machine company, and the generators will be made at the factory of the Electric company. When completed, they will be installed in the power-house of the Pennsylvania Railroad at Long Island City. The two large machines will furnish the power for some of the locomotives and the smaller ones will generate

the electric current for lighting the New York terminal station and the tunnels under the North and East rivers.

In the Long Island power house there are already installed three 9,000-h.p. Westinghouse turbo-generators, which were furnished some years ago. At that time they were considered the first turbo-generator units of any considerable size placed in service in this country.

The electric railway motors will be mounted on 50 passenger cars for the Long Island Railroad.

The Pennsylvania engineers in New York City and Altoona, in conjunction with the electric railway designers of the Westinghouse company, have about completed the design of the electric locomotives which will be used on the New York extension. Many novel features are embodied in the design. It is expected that work on these locomotives will be started early in April.

Traffic Club of New York.

At the regular monthly meeting on March 30, Oscar P. Austin, Chief of the Bureau of Statistics, Department of Commerce and Labor, Washington, D. C., will deliver an illustrated lecture on "Queer Transportation Methods in Curious Corners of the World."

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

AIR BRAKE ASSOCIATION.—F. M. Nellis, 53 State St., Boston, Mass.; May 11-14, 1909; Richmond, Va.

AMERICAN ASSOCIATION OF DEMURRAGE OFFICERS.—A. G. Thomason, Scranton, Pa.; May 11; St. Louis, Mo.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—R. W. Pope, 33 West 39th street, New York; second Friday in month; New York.

AMERICAN RAILWAY ASSOCIATION.—W. F. Allen, 24 Park Place, New York; May 19, 1909; New York.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—S. F. Patterson, B. & M., Concord, N. H.; Oct. 19, 1909; Jacksonville, Fla.

AMERICAN RAILWAY ENGINEERING AND MAINT. OF WAY ASSOC.—E. H. Fritch, Monadnock Bldg., Chicago.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 16-18, 1909; Atlantic City.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—C. W. Hunt, 220 W. 57th St.; N. Y.; 1st and 3d Wed., except July and August; New York.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. 39th St., N.Y.; 2d Tues. in month; annual, Dec. 7-10; New York.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—B. V. Swenson, 29 W. 39th St., New York.

ASSOCIATION OF AMERICAN RAILWAY ACCOUNTING OFFICERS.—C. G. Phillips, 143 Dearborn St., Chicago; April 28, 1909; Cincinnati.

ASSOCIATION OF RAILWAY CLAIM AGENTS.—E. H. Hemus, A., T. & S. F., Topeka, Kan.; last week in May, 1909; Detroit, Mich.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—P. W. Drew, Wisconsin Central Ry., Chicago; June 23-25, 1909; Detroit.

ASSOCIATION OF TRANSPORTATION AND CAR ACCOUNTING OFFICERS.—G. P. Conard, 24 Park Pl., New York; June 22-23; Montreal.

CANADIAN RAILWAY CLUB.—James Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Clement H. McLeod, Montreal, Que.; irregular, usually weekly; Montreal.

CENTRAL RAILWAY CLUB.—H. D. Vought, 95 Liberty St., New York; 2d Friday in January, March, May, Sept. and Nov.; Buffalo.

FREIGHT CLAIM ASSOCIATION.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.; June 16, 1909; Old Point Comfort, Va.

INTERNATIONAL MASTER BOILER MAKERS' ASSOCIATION.—Harry D. Vought, 95 Liberty St., N. Y.; April 27-30, 1909; Louisville, Ky.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—D. B. Sebastian, La Salle St. Station, Chicago; June 21-23, 1909; Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—E. C. Cook, Royal Insurance Bldg., Chicago; June 1-5; Chicago.

IOWA RAILWAY CLUB.—W. B. Harrison, Union Station, Des Moines, Ia.; 2d Friday in month, except July and August; Des Moines.

MASTER CAR BUILDERS' ASSOCIATION.—J. W. Taylor, Old Colony Bldg., Chicago; June 21-23, 1909; Atlantic City.

NEW ENGLAND RAILROAD CLUB.—G. H. Frazier, 10 Oliver St., Boston, Mass.; 2d Tues. in mnth, ex. June, July, Aug. and Sept.; Boston.

NEW YORK RAILROAD CLUB.—H. D. Vought, 95 Liberty St., New York; 3d Friday, in month, except June, July and August; New York.

NORTH-WEST RAILWAY CLUB.—T. W. Flannagan, Soo Line, Minn.; 1st Tues. after 2d Mon., ex. June, July, Aug.; St. Paul and Minn.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, Pittsburgh, Pa.; 4th Friday in month, except June, July and August; Pittsburgh.

RAILWAY SIGNAL ASSOCIATION.—C. C. Rosenberg, 12 North Linden St., Bethlehem, Pa.; March 15, 1909; Chicago.

RAILWAY STOREKEEPERS' ASSOCIATION.—J. P. Murphy, Box C, Collinwood, Ohio; May 17-19; Chicago.

ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Nov., 1909; Washington.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.

SOUTHERN ASSOCIATION OF CAR SERVICE OFFICERS.—J. H. O'Donnell, Bogalusa, La.; April 15; Altanta, Ga.

SOUTHERN AND SOUTHWESTERN RY. CLUB.—A. J. Merrill, Prudential Bldg., Atlanta; 3d Thurs., Jan., April, Aug. and Nov.; Atlanta.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.; September, 1909; Denver.

WESTERN RAILWAY CLUB.—J. W. Taylor, Old Colony Bldg., Chicago; 3d Tuesday each month except June, July and August; Chicago.

WESTERN SOCIETY OF ENGINEERS.—J. H. Warder, Monadnock Bldg., Chicago; 1st Wednesday, except July and August; Chicago.

Traffic News.

The Montana Demurrage Bureau had 34,338 cars reported in February, 1909, with a total average detention of 1.29 days and with 80.33 per cent. of the cars released in free time.

At Carson City, Nev., the federal grand jury has returned an indictment against the Southern Pacific on a charge of giving illegal rebates to the California Sugar & White Pine Agency.

The Central Passenger Association has voted to grant the request of merchants and others in Indianapolis who desire to have all passengers passing through that city allowed a stopover of ten days.

The Baltimore & Ohio announces that it will make another reduction in the rates on import freight from the Atlantic seaboard westward, from 67 cents per 100 lbs. (first class) to 64 cents. This is another step in the rate war which was begun by the Boston & Maine several months ago.

After a number of conferences of presidents, the controversy between the New York, New Haven & Hartford and the trunk lines, concerning the action of the New Haven in making low rates on freight to the West through Canada, has been referred to a committee consisting of Messrs. Brown (N. Y. C.); Hays (G. T.); Truesdale (D., L. & W.), and Walker (O. D. S. S.).

The Trunk Line Association announces that, beginning with April 26, when lake navigation will be open, the rate on grain from Lake Erie ports to New York harbor will be reduced from 5½ cents a bushel to 4 cents. Corresponding reductions will be made to Boston, Philadelphia and Baltimore. The announcement says that the new rates will be maintained 60 days. The Lackawanna first made this reduction and then the other lines followed. The purpose seems to be to forestall the competition of the water lines to Montreal, which last season was severe.

By the new passenger tariff which the New York Central has issued, to go into effect April 1, fares between all stations on the Hudson division between New York and Albany are calculated at the uniform basis of 2.17 cents a mile.

The Southern Demurrage and Storage Bureau had 52,649 cars reported in January, 1909, as compared with 47,773 cars in January, 1908. The total car days' detention in January this year amounted to 113,836 as against 112,257 in the previous year. The total average detention in January, 1909, was 2.11 as compared with 2.35 in 1908.

For the second time the Washington reporters tell us that the southern railways, as a result of conferences with shippers and with the Interstate Commerce Commission, have agreed to pay the overcharges which are due to shippers of lumber on account of the judicial decision that the rates for about two years were 2 cents higher than was reasonable. It is said that the amounts now refunded amount to about $3,000,000.

The Kansas House has passed a bill to reduce sleeping car rates. It provides the following maximum rates: For a lower berth for a trip not exceeding 150 miles, $1; for a trip of more than 150 miles and not exceeding 300 miles, $1.50; for a trip of more than 300 miles and not exceeding 400 miles, $2; for an upper berth, rates not to exceed three-fourths of the foregoing rates. The tourist sleeper rate would be 75 per cent. of the standard rates. For seats in parlor cars, a rate of 25 cents a hundred miles is fixed. The penalty for violation is a fine from $100 to $1,000 and from 30 days to six months in jail.

Clarence C. Gray, a member of the Minnesota Shippers' Association, has brought a suit against the Minneapolis & St. Louis to recover $6 for an alleged unlawful delay of six days in the transportation of a carload of corn in October, 1908, and in addition for an attorney's fee of $100. The action is brought under the Nolan reciprocal demurrage act, which provides that for every delay of 24 hours by a railway in promptly for-

warding a car the road shall pay $1 to the injured party. Counsel for the Minneapolis & St. Louis has filed an answer attacking the constitutionality of the act and alleging that it interferes with interstate commerce; and its validity will be tested in the resulting litigation.

The coal operators and miners in Iowa are protesting against reductions in rates on coal from points in Illinois to points in Iowa that have been announced by the Wabash, the Chicago & North Western, the Iowa Central and the Chicago, Milwaukee & St. Paul. The Wabash has made a rate of $1.50 per ton on coal in carload lots from Illinois coal fields to Des Moines, with proportionate rates to intermediate points. The North-Western, Iowa Central and St. Paul have made rates based on $1.60 per ton from Chicago to Des Moines 358 miles. The Iowa distance tariff rate is $1 per ton for a 100-mile haul, and the operators and miners in Iowa contend that the railways, in making the reduction in interstate rates without corresponding reductions in state rates, are discriminating against the mines in Iowa. Similar complaints have been made in the past and have always been answered by railway officers by a reference to the Iowa railway law, which requires them when they make a reduction in rates on any part of their line to make corresponding reductions on all other parts of their lines. Consequently, if they should make reductions in state rates from eastern Iowa corresponding to the reductions that they have made in interstate rates they would be obliged to make similar reductions in rates on coal throughout the state, and this would cause heavy losses in revenue.

By a new passenger tariff which the New York Central has issued, to go into effect April 1, fares between all stations on the Hudson division between New York and Albany are calculated at the uniform basis of 2.17 cents a mile, which is the present rate through from New York to Albany. The new tariff corrects inconsistencies in the construction of the local fares on the Hudson division, by reason of which the sums of locals were slightly less than the through fares between New York and Albany. These inconsistencies resulted in continual complaints. In some cases the new basis works an advance over the present fares; in others a reduction. The fares between New York and intermediate points north to Rensselaer, inclusive, will be slightly increased, and the fares from Albany to points south of Tivoli, inclusive, will be correspondingly decreased. Between New York and all points on this division round-trip tickets are sold at a slight reduction from double the one-way fares, and these round-trip fares are not disturbed. For example, under the new tariff the fare between New York and Fishkill one way will be $1.28 instead of $1.16 as at present. The round-trip fare will continue to be $2.25. A large proportion of the local travel to and from New York on the Hudson division is round-trip business. The maximum legal fare on the Hudson division is 3 cents a mile.

The Missouri, Kansas & Texas has announced a rate of 85 cents per 100 lbs. on dry goods from Galveston, Tex., to Oklahoma City, Okla. In connection with the low water rate from New York to Galveston, resulting from the steamship rate war, this will make a combination rate of $1.10 on these articles from New York to Oklahoma City. The through all-rail rate from New York to Kansas City is $1.47, and the merchants of Kansas City have protested against the rate given to Oklahoma City as a discrimination against them, and the Kansas City Commercial Club has declared a boycott against this road. It is reported that the Kansas City Southern will make a rate of $1.02 from Galveston to Kansas City. This, in connection with the ocean rate from New York to Galveston, will make a water and rail rate from New York to Kansas City of $1.27. C. Haile, Vice-President of the Missouri, Kansas & Texas, has asked the shippers at Kansas City to rescind their boycott in order that his road may have a chance to make a readjustment more satisfactory to the merchants of that city. The Chamber of Commerce and the Merchants Association of Guthrie, Okla., have adopted resolutions condemning the action of the Kansas City Commercial Club and threatening a boycott against the shippers at Kansas City unless they withdraw the boycott against the Missouri, Kansas & Texas. Similar action, it is reported, has been taken by 26 other commercial organizations in various parts of Oklahoma. The situation is a good illustration of the difficulty that railways constantly meet in making adjustments of rates satisfactory to competing commercial centers.

Officers of the railways in Missouri have decided to restore the 3-cent fare on state passenger business in that state on April 10. It is not improbable that further conferences between the officials of the state and the officers of the roads will be had regarding the litigation which resulted in Judge McPherson's decision holding the 2-cent fare law unconstitutional and which the state has anounced it will carry to the Supreme Court of the United States.

While the rate clerks of the railways are going ahead checking in passenger rates in Missouri on a 3-cent basis, Governor Hadley and Attorney-General Major, of that state, are daily issuing excited bulletins telling what they will do to the railways if the 3-cent fare is restored. In a statement issued on March 18, Governor Hadley said: "It is enough to say that if the 3-cent rate goes back at this time we will put our war paint on and begin beating our war drums. If the railways are disposed to treat Missouri unfairly they can rest assured that the Missouri authorities will allow them no quarter." He added that he and Attorney-General Major had agreed upon a plan of campaign against the railways. On the same day Mr. Major issued a long statement, saying that an investigation of state freight rates on coal had disclosed that some railways are interested in and perhaps control different mines and fix discriminatory rates, a condition which will not be permitted to exist. On March 21 Mr. Major issued another long statement, in which he said that the bill introduced in the legislature giving the State Railroad Commission power to fix maximum passenger rates within the limits prescribed by law was a precautionary step to put the state in a position to control the passenger fare situation as completely as can be done under the 2-cent fare law. He said he did not believe the roads would adopt 3-cent fares. A bill prohibiting railway companies from engaging in any business other than that of transportation has been introduced in both branches of the state legislature. It was drawn by Governor Hadley and Attorney-General Major. Mr. Major announced that he has decided to call a conference of the attorney-generals of Missouri, Illinois, Nebraska, Kansas, Arkansas and Iowa to plan a concerted campaign against advances in passenger rates above 2 cents a mile.

INTERSTATE COMMERCE COMMISSION.

Carstens Packing Co. vs. Oregon Short Line.

Carstens Packing Co. v. Oregon Short Line et al. Opinion (842) by Commissioner Lane. Case No. 1668.

Complainant made shipments of cattle from Nampa, Idaho, to Tacoma, Wash., but in order to combine these cars with others instructed that the shipments go forward on combination rates based on Ontario, Ore. This combination was higher than the through rate. Since the reasonableness of the rates charged is not in issue, the commission has no authority to grant relief.

Discriminations Against Indianapolis.

Indianapolis Freight Bureau v. Cleveland, Cincinnati, Chicago & St. Louis et al. Opinion (844) by Commissioner Clements. Case No. 1041.

Complainant alleges unjust discrimination in rates on various articles from Indianapolis to East St. Louis, Ill., and St. Louis, Mo., as compared with rates on the same articles from Chicago. While recognizing the differences in competitive conditions as between Indianapolis and Chicago, the commission is convinced that the disparities between existing rates from these respective points of origin are too great on some commodities, and prescribes a proper relative adjustment on iron and steel articles, castings, burlap and gunny bags, furniture and chairs, iron beds, and wooden ladders.

Complainant challenges the reasonableness of the Official Classification rule providing for the application of fourth class ratings on castings, japanned, in carloads, and third class on less than carloads. Formerly carload-shipments of such articles were charged fifth class rates and less-than-carload ship-

ments, fourth class. The application of the higher ratings is condemned and the carriers ordered to apply fifth class ratings on carload and fourth class on less-than-carload shipments. These ratings were applied during a long period of time and the advance results solely from conformance with a rule which follows an arbitrary line of demarcation for the convenience of the carriers in applying a general classification basis. This does not constitute a sound transportation reason for such marked differences in rates, and no other conditions appear as a warrant therefor.

Complainant alleges unjust discrimination against Indianapolis in that a rule permitting the use of two cars at the highest minimum weight and the lowest rate provided for one car to accommodate shipments of light and bulky articles is applied at Chicago, while the same is denied on similar shipments from Indianapolis to western trunk-line territory and to Mississippi river crossings. The commission is of the opinion that the application of this so-called two-for-one rule from Chicago and its non-application from Indianapolis results in such great disparities between the freight charges from these respective points as to work an unjust discrimination against the place last mentioned, but the rule in the form in which it is applied at Chicago will not be extended. However, a rule similar in substance, but so restricted and modified as to prevent its improper manipulation, should be extended to Indianapolis or else the unlawful discrimination should be removed by a readjustment of the minimum weights on the various articles referred to in the complaint so that they will conform approximately to the actual loading capacity of cars. This feature of the complaint will be retained, and if at the end of three months from this time the carriers have been unable to remove the discrimination, the commission will then make such order as may appear necessary and proper.

The complainant alleges the exaction by defendants of unreasonable class rates from Indianapolis to Ohio river points and to Chicago, respectively, as compared with rates between Chicago and the Ohio river. The mere fact that there is a greater percentage disparity between rates on two classes from Indianapolis than on two other classes, or that a disparity greater in one case than in another exists between the corresponding classes from Indianapolis and Chicago, does not afford a just or proper basis or reason for the rearrangement of rates and disturbance of conditions, commercial and otherwise, throughout a large territory when it is manifest that the established system is the outgrowth of actual conditions and the result of a gradual development. No showing has been made that the present rates are unreasonable or unjust in and of themselves, or that they yield to the carriers' exorbitant earnings for the transportation service. This prayer of the petition is denied.

The commission is not convinced that the present proportional rates published from Indianapolis to Ohio river crossings for application on through traffic to southeastern territory are unreasonable. It is evident that proportional rates from more distant points must be less per mile to permit such points to compete in the common market, and the commission does not feel warranted in condemning a system of rate making whereby wholesome competition between producing centers is preserved when no showing is made that the rates complained of are unreasonable or do in fact result in unjust discrimination, or that the more advantageous geographical location of one point has been disregarded and vitiated by an abnormal adjustment.

Exception to Combination of Locals Rule.

Harlow Lumber Co. v. Atlantic Coast Line et al. Opinion (843) by Chairman Knapp. Case No. 1397.

Complainant alleged that a through rate of 32 cents per 100 lbs. upon lumber, in carloads, from Warsaw, N. C., to Chappaqua, N. Y., was unreasonable, because it exceeded the combination of local charges to and from New York, but it appeared that for reasons stated complainant could not have taken advantage of the combination of local charges, except at an expense as great or greater than the through rate. The record does not therefore disclose a typical through rate in excess of the combination of locals such as has been condemned in general terms by the commission. Reparation denied.

Car Capacity and Minimum C. L. Weights.

J. Rosenbaum Grain Co. v. Missouri, Kansas & Texas et al. Opinion (842) by Commissioner Cockrell. Case No. 1771.

Defendants collected from complainant 18½ cents per 100 lbs. on 60,000 lbs. of wheat shipped in a car of 55,000 lbs. maximum capacity from Kansas City, Kan., to Galveston, Tex., for export, and thus collected on 5,000 lbs. more than the maximum loading capacity of the car. This was an unreasonable charge and reparation is awarded. The tariff provision of the defendants prescribing a minimum weight on all shipments of wheat for export from Kansas City to Galveston is unreasonable and in direct conflict with the administrative rulings of this commission.

STATE COMMISSIONS.

In compliance with an order by the Indiana Railroad Commission work has begun on the construction of a connecting track between the Pennsylvania and the Chicago, Cincinnati & Louisville in Richmond, Ind. This display of activity on the part of the Pennsylvania Company ends a long fight with the State Railroad Commission. The commission found that 90 per cent. of the output of the factories in Richmond could be loaded directly on cars of the Pennsylvania lines, while shippers had to cart their products to the freight house of the C., C. & L. Cars of the C., C. & L. will now be run over the Pennsylvania tracks to the factories for loading.

Restoration of Two-and-a-Half-Cent Fares in Virginia.

The State Corporation Commission of Virginia, on March 16, delivered an opinion permitting the railways of the state to increase their passenger fares from 2 cents a mile to 2½ cents. The commission is not unanimous in its opinion, Commissioners Prentis and Willard voting for the increase as asked by the roads and Commissioner Rhea dissenting and urging that the old rate is not unreasonable. He holds that before any increase whatever is permitted the roads should give assurance that they will place on sale and keep on sale books to be sold at 2 cents a mile, interchangeable. He also expresses the belief that the roads should give this assurance before any action is taken looking to the termination of the present rate cases in the federal courts.

The order of the commission provides that mileage books and party rate tickets at reduced rates be retained, the mileage books to be interchangeable, good on any road in the state. The opinion makes no reference to this, but it is embraced in the order of the commission. The new rule is designed to go into effect April 1. The opinion holds that the railways have shown that under the 2-cent maximum rate the revenues of the roads have decreased, while the actual interstate traffic has increased. Many interstate passengers, desiring to save the half cent a mile, have bought tickets to points at the boundaries of the state and then in continuing their journeys have bought the rest of their tickets at other points.

The Southern Railway Company announces that when these advanced rates are put into effect on its lines, as is expected to be done on April 1, the entire system of mileage books which is in use on its lines in the states of North Carolina, South Carolina, Georgia, Alabama and Tennessee will be extended to Virginia.

New York: Buffalo, Rochester & Eastern Refused a Certificate.

The New York Public Service Commission, Second district, voted, on March 16, not to grant the application of the Buffalo, Rochester & Eastern for a certificate of public convenience and necessity to build a railway in general paralleling the New York Central & Hudson River between Buffalo and Troy. Commissioners Stevens, Decker, Sague and Olmsted voted against granting the certificate; Commissioner Osborne declined to vote. This application has been before the commission for more than a year, and was supported by a considerable local sentiment along the proposed route.

The commission voted against the building of the new road because there was not sufficient financial backing; because the

cost would have been so great that the road would have had to earn returns on a greater capitalization than any other in the country, earning about $48,000 a mile, where, in 1906, no road in the country earned $40,000 a mile gross; because, therefore, a greater tonnage would be required than that of any railway in the country; because the eastern outlet of the road would be in no condition to handle additional business, and the western terminus have no additional business to furnish; because existing railway facilities could handle the present business adequately and care for such increase as developed; because no public benefit as to cheaper transportation would result, and because the local business to be accommodated would not warrant the building of a new road—a conclusion admitted at hearings by the applicant.

The commission showed that the Boston & Maine, the sole Eastern connection of the proposed line, in full tide of business of 1907, was unable to take care of the business offered it by its western connections and that this inability was one of the causes of congestion and delay in the business of that year of railways in New York state. An average of 770 loaded cars a day was the utmost the Boston & Maine could handle, while the business the Buffalo, Rochester & Eastern would be compelled to offer it to pay necessary charges would be fully as much more.

The commission stated that the cost of building the 297 miles of the proposed road was placed by the applicant at $85,559,018, but that an examination of the evidence and the report of the commission's engineers placed the cost approximately at $100,000,000. "The financial ability of the applicant as shown on hearings was that it has a total authorized capital stock of $3,500,000," says the commission, "of which only $350,000 has been subscribed by persons whose aggregate financial resources do not exceed from $10,000,000 to $15,000,000. None of these persons is shown to have experience in the building, operation or management of steam railways or any connection with or control over financial resources other than as stated."

Ralph D. Gillette is President and A. D. Robinson Secretary of the proposed road. Both live at Westfield, Mass.

COURT NEWS.

In the United States Circuit Court at Buffalo, N. Y., Judge Hazel has imposed a fine of $20,000 against the Standard Oil Co. in the long pending suits concerning illegal rates charged for the transportation of oil from Olean, N. Y., by way of Rochester to points in Vermont.

The statement on page 475 of our issue of March 5 that "the Supreme Court of Pennsylvania has decided that the state law stipulating the length of time goods may be kept in storage is invalid, so far as it applies to goods in cars that are engaged in interstate commerce," was incorrect. The decision was not by the Supreme Court of Pennsylvania but by the Superior Court, a court intermediate between the District Court and the Supreme Court, and was rendered in the case of the Pennsylvania Railroad vs. M. O. Coggins & Co. on an appeal from the decision of the District Court. It was a case where the Pennsylvania sued for demurrage and the defendant claimed that under the state law of Pennsylvania he was entitled to more time than was allowed by the rules which the Pennsylvania Railroad had filed with the Interstate Commerce Commission. The decision in brief is that on interstate business the demurrage rules filed with the Interstate Commerce Commission shall govern and that the rules as established by the state of Pennsylvania do not apply.

The Supreme Court of Texas has rendered a decision holding that any rate which is not in itself reasonably remunerative cannot be forced on a railway. The decision was rendered in a case brought by the Gulf, Colorado & Santa Fe against the State Railroad Commission, which had prescribed a rate on lumber that the Santa Fe alleged was confiscatory. The Railroad Commission filed a demurrer to the railway's bill, contending that when the rates on a railway as a whole afford a reasonable profit no particular rate could be classed as unreasonable. The Supreme Court rejected this view. This is a decision of obvious importance as applied to the situation in Texas, for it holds in effect that a railway is entitled to earn a profit on the transportation of each and every kind of traffic, if not actually upon each and every shipment. It has been the policy of the Texas Commission for years to make innumerable small reductions, no one of which it believed could be attacked alone as confiscatory.

Noble C. Butler, Special Master in Chancery of the Federal court at Terre Haute, Ind., has made a finding, holding that a schedule of rates fixed by the Railroad Commission of Indiana to be applied by the Vandalia is so low that the earnings under it would not pay operating expenses. The commission ordered substantial reductions in all freight rates on the Vandalia between Indianapolis and the Illinois state line. The Master says that if the schedule fixed by the commission had been applied it would have resulted in the following losses by the company in the years mentioned: 1904, $7,232; 1905, $6,428; 1906, $7,331.

May Charge Extra for Delivering Express Packages.

The Indiana Supreme Court has sustained the rule adopted by the express companies to make an extra charge for delivering packages in cities beyond certain bounds.

Hearing in Harriman Lines Case.

Testimony in the suit brought by the government to dissolve the alleged illegal combination of the Union Pacific, the Southern Pacific and affiliated lines was taken in Chicago last week. Traffic managers of a large number of industrial concerns at Chicago, Detroit, Quincy, Moline and other interior jobbing points were questioned as to the effect on competition between the Union Pacific and Southern Pacific of the common control of these properties. They generally stated that the solicitation of their shipments by the representatives of the two roads is less keen than it was before 1901.

J. W. Morse, who was formerly a General Agent of the Union Pacific, said that prior to the consolidation competition was active between the Union Pacific and the Southern Pacific for transcontinental business, but that after they came under common control it became less sharp. A number of witnesses said that after W. G. Neimyer became General Agent of both lines at Chicago the representatives of the two roads seemed to become equally willing that traffic should move by either line. The testimony of a number of witnesses showed that the amount of rebates given to secure transcontinental business was substantially reduced after the alleged combination. F. B. Montgomery, Traffic Manager of the International Harvester Co., and O. F. Bell, Traffic Manager of the Crane Company, said that competition between the two lines seemed to have grown less active, but Mr. Bell said that service on the two roads had shown an improvement in recent years.

P. P. Heinricks, Traffic Manager of P. Becker & Co., of Chicago, a concern that sells leather hand bags and trunks, said that owing to the recent increase in freight rates to the coast charges on these goods had become prohibitive.

J. C. Stubbs, Traffic Director of the Harriman Lines, was a witness on March 19, being called by the government to identify an argument made by him at an arbitration conference in Chicago in December, 1898, before the Union Pacific acquired control of the Southern Pacific. The question being arbitrated was whether the Canadian Pacific should be given a differential under the United States lines on transcontinental business, and in his argument Mr. Stubbs, then as now Vice-President of the Southern Pacific, mentioned the Union Pacific as an active competitor of the Southern Pacific. With reference to his argument at that time, Mr. Stubbs said that he then appeared not as a witness but as an advocate and that some allowance should be made for that fact. He said that the natural and most practicable route for transcontinental shipments over the Union Pacific to the coast is over the Southern Pacific from Ogden to San Francisco.

Hearings were held at St. Louis March 22 and 23, and have been announced for April 27 at Salt Lake City.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF JANUARY, 1909.
See also issues of March 5 and 12.

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama Great Southern	309	$185,537	$91,506	$307,255	$39,390	$55,096	$7,394	$105,099	$7,200	$214,179	$93,076	$463*	$11,489	$81,124	$72,032
Ann Arbor	301	95,635	30,270	134,323	17,944	22,771	2,956	58,948	4,672	107,291	27,032	1,723*	11,369	13,940	13,770
Atlanta, Birmingham & Atlantic	642	120,596	38,136	173,497	26,364	35,273	12,447	78,908	8,362	161,354	12,143	.....	8,000	4,143	‡21,583
Buffalo & Susquehanna	373	167,217	14,116	187,467	29,215	48,869	2,334	84,534	7,394	172,346	15,121	39*	4,000	11,082	22,245
Central Vermont	411	168,537	56,788	247,163	24,579	41,658	6,510	141,061	7,572	221,380	25,783	530	9,025	17,288	4,880
Chicago & Erie	270	236,090	56,621	329,761	30,988	78,831	11,759	175,371	8,482	305,431	24,330	442	11,083	13,689	96,814
Chicago, Indiana & Southern	329	241,919	15,621	265,603	27,243	52,469	6,941	100,406	7,213	194,272	71,331	101*	12,500	58,730	24,016
Chicago, Indianapolis & Louisville	616	231,808	89,842	359,955	47,294	71,499	11,211	148,708	13,525	292,237	67,718	.....	21,500	46,218	7,536
Chicago, Rock Island & Gulf	493	191,058	65,825	268,385	52,561	19,628	5,807	108,432	8,996	195,424	72,961	37	6,261	66,737	‡87,716
Cincinnati, Hamilton & Dayton	1,036	403,777	113,610	579,217	66,255	123,966	19,695	299,071	22,220	531,207	48,010	.....	24,629	23,381	11,688
Cincinnati, New Orleans & Tex. Pac.	337	504,495	125,844	662,813	82,214	121,609	17,586	192,419	17,689	431,517	231,296	2,222*	19,642	209,432	182,553
Duluth, South Shore & Atlantic	593	126,800	56,061	196,966	28,387	27,755	7,717	92,657	5,842	162,358	34,608	717*	16,000	17,891	‡7,642
El Paso & Southwestern	867	488,467	85,459	599,081	78,556	82,583	10,093	185,582	30,674	387,488	211,593	414*	17,167	194,012	71,685
Fort Worth & Denver City	454	252,322	132,159	404,194	67,470	71,933	6,056	137,130	14,802	297,391	106,803	259	9,318	97,744	‡39,398
Grand Trunk Western	336	277,659	125,579	435,101	27,832	64,871	18,961	186,028	14,014	311,706	123,395	1,184*	32,000	90,211	48,676
Hocking Valley	347	322,547	61,755	399,522	44,822	104,535	7,713	148,774	12,803	318,647	80,875	976*	18,495	61,404	61,539
Houston & Texas Central	789	302,686	99,454	434,727	57,684	74,337	16,534	196,839	19,607	365,001	69,726	.....	19,632	50,094	‡70,040
International & Great Northern	1,159	483,521	128,755	655,330	135,653	125,771	15,778	299,268	20,185	596,655	58,675	.....	19,000	39,675	22,845
Iowa Central	558	186,223	36,741	235,457	13,933	56,002	8,496	116,154	8,987	203,572	31,885	.....	7,371	24,514	‡62,332
Long Island	392	187,299	279,468	488,512	70,938	103,111	10,173	305,074	18,288	507,584	19,072*	36,186	21,713	4,599†	‡93,028
Minneapolis & St. Louis	1,027	200,609	69,412	299,242	20,292	51,046	10,668	135,574	11,232	228,812	70,430	183*	16,182	54,065	‡4,211
Minneapolis, St. Paul & S. S. Marie	2,395	467,653	210,313	730,666	76,978	101,930	20,094	306,646	23,566	529,214	201,452	18,098	53,385	166,165	‡27,010
New York, Chicago & St. Louis	556	625,070	103,034	751,853	51,538	105,654	46,303	359,401	15,522	578,418	173,435	1,880*	26,000	145,554	51,187
New York, Ontario & Western	546	503,851	66,503	591,312	65,377	122,708	9,842	254,225	13,627	465,779	125,533	1,442*	15,417	108,674	‡7,481
Northwestern Pacific	373	58,813	78,916	156,935	34,256	33,991	2,076	81,511	9,997	161,831	4,896*	.....	8,955	13,851†	52,662
Oregon R. R. & Nav. Co	1,327	447,767	212,847	720,071	60,161	64,882	26,375	271,306	29,928	452,652	267,419	.....	71,304	185,749	‡272,423
Pere Marquette	2,354	783,519	229,358	1,096,667	128,998	174,363	28,283	482,952	31,477	846,073	250,594	50	47,377	203,267	31,713
Philadelphia & Reading	1,007	2,540,392	466,289	3,144,289	235,286	757,130	34,799	1,046,382	59,404	2,133,001	1,011,288	24,708	61,262	974,734	270,803
Rutland	468	107,249	61,663	195,834	27,338	32,603	6,396	86,025	4,947	157,309	38,525	.....	8,756	29,769	15,232
San Antonio & Aransas Pass	727	177,201	68,901	263,653	50,221	38,824	4,335	120,808	8,530	222,718	40,935	.....	8,500	32,435	11,172
San Pedro, Los Angeles & Salt Lake	1,099	331,251	217,676	585,730	61,940	99,730	29,160	209,674	17,837	418,341	167,389	3,190*	24,470	139,729	109,906
Seaboard Air Line	2,611	973,736	304,138	1,424,963	194,320	208,838	58,144	480,209	47,793	989,304	435,659	943*	50,500	384,216	151,856
Southern Pacific—Pacific System	5,589	3,262,747	1,974,965	5,671,543	721,121	838,130	118,572	1,750,954	198,713	3,627,490	2,044,053	22,114*	245,239	1,776,700	194,119
Stephensville, No. & So. Texas	43	6,876	1,313	8,879	695	863	168	2,305	678	4,710	4,169	.....	92	4,077	.....
Toledo & Ohio Central	441	205,400	46,223	262,461	35,851	45,576	4,882	108,819	4,903	200,031	62,430	3,034	13,599	51,865	1,473
Wheeling & Lake Erie	442	325,654	32,339	379,173	29,112	119,421	7,111	161,800	14,643	332,086	47,087	546	20,791	26,842	23,451
SEVEN MONTHS OF FISCAL YEAR.															
Alabama Great Southern	309	1,319,698	600,063	2,121,904	282,026	411,784	52,291	705,073	58,178	1,509,352	612,552	4,936*	80,306	527,310	213,102
Ann Arbor	301	689,391	289,178	1,046,703	147,142	144,918	21,362	406,871	28,771	749,064	297,639	16,500	79,581	234,558	‡21,690
Atlanta, Birmingham & Atlantic	642	829,261	283,366	1,184,053	144,796	209,322	64,224	444,821	46,908	910,071	273,982	.....	47,000	226,982	21,834
Buffalo & Susquehanna	373	1,191,696	124,648	1,359,663	234,280	303,534	17,560	501,852	48,437	1,105,663	254,000	779*	28,000	225,221	95,601
Central Vermont	411	1,290,781	632,124	2,079,847	307,895	345,760	53,435	961,746	48,411	1,717,247	362,600	6,446	63,175	305,871	‡76,008
Chicago & Erie	270	1,816,660	464,368	2,489,765	254,866	572,851	80,353	1,174,635	54,171	2,136,876	352,889	2,043	79,163	275,769	209,782
Chicago, Indiana & Southern	329	1,450,407	149,536	1,654,389	184,344	321,654	53,596	636,946	48,714	1,245,254	409,135	13,301	100,042	322,394	88,591
Chicago, Indianapolis & Louisville	616	2,029,396	808,863	3,127,003	490,182	484,561	86,832	1,024,736	95,515	2,181,826	945,177	.....	150,500	794,677	‡31,197
Chicago, Rock Island & Gulf	493	1,246,118	443,369	1,776,981	420,487	144,100	42,469	675,941	60,766	1,343,763	433,218	1,169*	22,294	409,755	‡125,079
Cincinnati, Hamilton & Dayton	1,036	3,313,654	1,027,003	4,829,082	557,877	911,585	151,378	2,042,739	148,141	3,811,720	1,017,362	.....	175,023	842,339	224,748
Cincinnati, New Orleans & Tex. Pac.	337	3,460,169	857,911	4,550,917	514,710	905,237	116,008	1,372,976	121,618	3,030,549	1,520,368	12,179*	137,494	1,370,695	483,515
Duluth, South Shore & Atlantic	593	923,733	558,896	1,580,825	248,707	191,502	63,111	599,495	46,805	1,149,620	431,205	8,807	117,783	322,229	‡75,292
El Paso & Southwestern	867	3,274,988	553,221	4,016,089	487,521	555,252	65,808	1,093,340	159,592	2,361,513	1,654,576	12,755*	108,709	1,533,112	.....
Fort Worth & Denver City	454	1,871,439	1,068,672	3,074,972	475,526	432,109	51,668	921,538	101,050	1,981,891	1,093,081	4,067	61,719	1,035,429	‡46,479
Grand Trunk Western	336	2,054,636	1,056,197	3,301,427	279,284	445,844	142,552	1,246,858	80,367	2,194,905	1,106,522	6,011*	224,000	876,511	375,364
Hocking Valley	347	3,216,933	527,059	3,857,692	382,395	914,459	53,233	1,127,544	83,824	2,561,455	1,296,237	47,100	140,077	1,203,260	145,089
Houston & Texas Central	789	2,693,859	877,990	3,789,027	499,566	502,727	105,136	1,366,830	136,152	2,610,411	1,178,616	.....	75,272	1,103,344	60,573
International & Great Northern	1,159	3,655,982	1,041,229	5,008,083	802,237	765,165	107,902	1,939,029	142,617	3,756,950	1,251,133	.....	157,000	1,094,133	824,217
Iowa Central	558	1,365,935	319,382	1,770,551	157,578	323,953	61,761	775,732	60,551	1,379,575	390,976	.....	51,749	339,227	‡274,525
Long Island	392	1,521,853	3,174,852	4,894,819	583,422	711,499	100,668	2,184,339	124,013	3,703,941	1,190,878	584,834	151,995	1,623,717	493,690
Minneapolis & St. Louis	1,027	1,719,587	680,417	2,577,231	228,568	325,912	70,118	915,182	83,716	1,623,496	953,735	278*	108,486	844,971	57,286
Minneapolis, St. Paul & S. S. Marie	2,395	5,309,636	1,853,321	7,518,769	728,683	818,497	138,669	2,255,147	158,925	4,099,921	3,418,848	185,897	536,543	3,068,202	573,589
New York, Chicago & St. Louis	556	4,389,515	895,566	5,464,291	542,804	529,874	306,770	2,188,472	92,040	3,659,960	1,804,331	6,616*	211,510	1,586,205	‡287,541
New York, Ontario & Western	546	3,713,085	1,021,882	4,931,512	543,423	848,007	68,559	1,791,003	102,108	3,353,100	1,578,412	20,453*	107,917	1,450,042	‡79,035
Northwestern Pacific	373	741,170	976,726	1,859,645	385,852	253,683	15,841	650,023	65,662	1,371,061	488,584	.....	63,785	424,799	18,900
Oregon R. R. & Nav. Co	1,327	5,346,741	2,054,562	7,845,145	790,949	513,244	150,675	2,074,066	202,602	3,731,536	4,113,609	15,435*	333,065	3,765,109	‡417,920
Pere Marquette	2,354	5,534,080	2,129,990	8,322,956	989,824	1,216,663	183,339	3,251,586	201,959	5,843,371	2,479,585	9,570	356,961	2,132,194	193,939
Philadelphia & Reading	1,007	18,331,306	3,635,518	22,933,116	1,781,438	4,691,409	251,722	6,979,387	388,940	14,092,896	8,840,220	197,342	426,952	8,610,610	‡844,194
Rutland	468	899,133	636,993	1,721,695	249,691	223,595	43,500	651,935	40,336	1,209,057	512,638	.....	65,419	447,219	92,679
San Antonio & Aransas Pass	727	1,740,318	510,521	2,372,374	331,126	256,145	29,629	868,188	60,830	1,545,918	826,456	.....	61,700	764,756	194,254
San Pedro, Los Angeles & Salt Lake	1,099	2,394,193	1,429,120	4,082,025	670,245	546,901	168,060	1,348,760	121,800	2,855,766	1,226,259	16,897*	168,494	1,040,868	340,130
Seaboard Air Line	2,611	6,365,139	1,968,004	9,210,641	1,351,893	1,346,826	332,833	3,235,132	334,804	6,601,488	2,609,153	9,979*	353,500	2,245,674	471,635
Southern Pacific—Pacific System	5,589	29,214,250	15,488,218	47,845,505	5,755,381	5,966,052	789,915	12,787,020	1,390,477	26,688,845	21,156,660	62,708*	1,623,905	19,470,047	2,574,803
Stephensville, No. & So. Texas	43	61,960	11,047	75,330	5,154	5,086	1,128	16,602	3,970	31,940	43,390	.....	641	31,299	.....
Toledo & Ohio Central	441	2,258,071	389,296	2,735,629	373,229	411,480	38,486	863,044	38,001	1,724,240	1,011,389	24,287	97,597	938,079	114,196
Wheeling & Lake Erie	442	2,866,344	303,958	3,383,986	408,531	783,265	39,085	1,159,167	101,072	2,491,120	892,866	6,094	152,840	746,120	91,147

*Deficit. †Loss. ‡Decrease.

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF JANUARY, 1909.
(See also table on preceding page.)

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Atlanta & Birmingham Air Line....	237	$53,193	$19,232	$76,826	$11,193	$6,917	$896	$32,218	$1,548	$52,772	$24,054	.....	$4,813	$19,241	$6,066
Central Branch.....	388	89,146	27,790	126,590	30,067	17,969	4,074	53,820	4,120	110,050	16,540	.....	9,500	7,040	‡42,725
Charleston & Western Carolina.....	340	83,696	20,742	111,246	23,632	17,094	2,633	48,383	3,978	95,720	15,526	.....	4,100	11,426	‡8,378
Chicago & Alton.....	998	599,534	293,599	978,802	86,916	121,978	42,987	370,486	38,028	660,395	318,407	$1,310*	30,000	287,097	‡11,973
Chicago, Cincinnati & Louisville....	285	84,587	17,706	108,037	15,581	25,652	7,633	56,872	5,917	111,655	3,618*	.....	3,250	6,868†	14,841
Chicago Great Western.....	818	439,297	123,973	614,824	58,190	135,098	35,917	326,414	37,040	592,659	22,165	1,252*	18,058	2,855	‡88,460
Chicago, Peoria & St. Louis Ry. of Ill.	255	102,761	20,903	129,691	17,090	28,891	6,033	64,903	5,118	122,035	7,656	.....	4,300	3,356	7,054
Colorado Midland.....	338	140,024	23,530	197,256	19,870	28,483	9,674	81,445	5,796	145,268	51,988	744*	6,099	45,145	37,262
Detroit & Mackinaw.....	348	64,230	19,717	89,480	13,744	16,152	1,755	31,820	2,679	66,150	23,330	223*	6,863	16,244	‡4,972
Duluth, Missabe & Northern.....	282	64,866	28,589	97,740	48,976	42,737	1,521	60,765	11,812	165,811	68,071*	1,685*	4,513	74,269†	‡9,535
Evansville & Terre Haute.....	310	102,982	44,717	164,192	16,412	30,428	3,627	59,394	5,934	115,795	48,397	425*	9,035	38,937	‡4,688
Fort Worth & Rio Grande.....	196	108,011	27,902	141,848	9,749	10,564	3,449	39,107	5,546	68,415	73,433	.....	1,900	71,533	65,339
Georgia	307	161,259	57,128	234,011	25,996	30,183	8,235	101,076	6,637	172,127	61,884	.....	1,123	60,761	37,603
Georgia Southern & Florida.....	395	99,077	52,622	169,074	21,799	25,213	5,284	67,842	8,541	128,679	40,395	1,760	8,381	33,774	14,980
Kanawha & Michigan.....	177	120,221	22,521	147,788	28,004	47,316	2,213	49,833	3,430	130,796	16,992	10*	6,575	10,407	14,444
Louisiana Ry. & Nav. Co.....	343	83,910	11,293	100,875	25,308	13,074	3,649	48,708	6,246	96,985	3,890	.....	3,750	140	‡8,677
Mason City & Fort Dodge.....	386	100,397	28,653	137,229	10,535	23,927	1,685	86,471	979	123,597	13,632	141	8,937	4,836	‡39,938
Midland Valley.....	324	55,114	23,582	83,449	15,924	18,695	1,720	31,301	4,653	72,293	11,156	.....	8,000	3,156	‡2,064
Missouri Pacific.....	3,492	1,137,119	303,309	1,621,554	227,021	250,829	52,531	782,691	58,572	1,371,644	249,910	2,982*	77,105	169,823	‡5,971
Mobile, Jackson & Kansas City.....	403	114,775	26,013	149,697	24,359	16,312	1,772	41,512	9,688	93,643	56,054	.....	3,309	52,745	38,346
Nevada & California.....	379	79,958	21,186	108,798	7,833	9,264	771	33,718	1,841	53,427	55,371	1,045*	6,000	48,326	19,456
New York, Susquehanna & Western..	151	130,942	43,276	199,244	12,968	21,478	1,642	76,102	3,674	115,864	83,380	667*	15,089	67,624	‡3,948
Peoria & Eastern.....	352	144,863	45,770	208,761	18,500	40,704	5,037	103,030	4,977	172,248	36,513	.....	8,800	27,713	‡57,235
Pittsburgh & Lake Erie.....	191	719,940	87,598	837,228	88,798	70,003	12,240	240,673	19,697	431,411	405,817	347*	17,000	388,470	200,703
Quincy, Omaha & Kansas City.....	262	45,872	16,072	66,583	12,280	12,870	1,667	37,589	3,690	68,096	1,513*	.....	2,450	3,963†	‡2,221
St. Joseph & Grand Island.....	319	83,222	28,305	120,139	18,495	14,254	5,665	48,284	3,561	90,259	29,880	105	5,142	24,843	‡17,164
St. Louis & San Francisco.....	4,727	1,848,425	745,697	2,826,633	343,807	393,790	70,760	1,062,118	77,042	1,947,517	879,116	.....	120,681	758,435	‡62,168
St. Louis, Brownsville & Mexico.....	454	63,402	33,128	103,307	19,793	13,792	3,001	37,613	5,592	79,791	23,516	273	3,001	20,242	5,567
St. Louis, Iron Mtn. & Southern....	2,608	1,338,074	406,587	1,925,108	291,527	254,418	46,358	669,296	58,361	1,319,960	605,148	4,866*	63,161	537,121	130,618
Santa Fe, Prescott & Phoenix.....	257	67,717	27,249	100,621	17,729	7,321	2,541	24,718	4,760	57,079	43,542	.....	.....	43,542	9,334
Texas Central.....	268	66,809	31,377	105,781	18,310	13,851	1,129	32,725	5,068	71,083	34,698	.....	3,058	31,640	5,800
Toledo, Peoria & Western.....	248	54,069	27,216	85,939	15,451	19,538	2,035	36,954	3,279	77,257	8,682	.....	4,000	4,682	‡19,851
Toledo, St. Louis & Western.....	451	190,262	31,790	241,504	30,604	33,956	3,960	103,084	7,933	179,537	61,967	.....	11,500	50,467	‡11,660
Trinity & Brazos Valley.....	455	175,804	11,793	190,613	44,055	26,875	4,535	103,033	13,321	191,819	1,206*	.....	3,300	4,506†	53,639
Western Maryland.....	543	401,423	49,826	471,300	41,844	73,024	5,719	164,693	12,827	298,107	173,193	.....	16,500	156,693	29,868
Wisconsin, Minnesota & Pacific.....	271	33,800	12,379	50,505	5,570	5,074	280	21,801	262	32,987	17,518	29*	3,443	14,046	‡1,492
SEVEN MONTHS OF FISCAL YEAR.															
Atlanta & Birmingham Air Line....	237	$382,255	$146,053	$556,109	$84,167	$40,242	$8,929	$217,086	$14,036	$364,460	$191,649	.....	$33,693	$157,956	$35,952
Central Branch.....	388	758,205	206,663	1,038,218	171,118	129,454	22,865	348,542	26,840	698,819	339,399	.....	66,500	272,899	30,497
Charleston & Western Carolina.....	340	589,183	163,791	805,017	162,630	105,224	17,303	305,444	23,600	614,201	190,816	.....	28,700	162,116	14,075
Chicago & Alton.....	998	4,692,710	2,377,820	7,678,017	717,366	844,380	273,288	2,399,186	215,762	4,449,982	3,228,035	$6,734*	210,000	3,011,301	658,071
Chicago, Cincinnati & Louisville....	285	588,762	174,696	802,571	192,546	176,675	53,952	349,387	41,726	814,286	11,715*	.....	22,750	34,465†	‡3,878
Chicago Great Western.....	818	3,452,440	1,174,021	4,995,690	682,197	885,217	254,873	2,154,554	217,654	4,194,495	801,195	5,172*	128,219	667,804	‡148,839
Chicago, Peoria & St. Louis Ry. of Ill.	255	709,421	203,639	959,212	135,376	213,353	42,588	392,061	33,520	816,898	142,314	.....	31,900	110,414	26,422
Colorado Midland.....	338	1,001,063	237,968	1,427,038	174,768	186,871	68,568	575,936	40,936	1,047,079	379,959	2,227*	52,599	325,133	37,417
Detroit & Mackinaw.....	348	431,670	178,128	648,178	109,809	102,436	13,266	219,403	19,572	464,486	183,691	2,433*	51,067	130,191	‡46,666
Duluth, Missabe & Northern.....	282	6,521,481	209,174	6,765,276	524,875	555,150	8,770	857,933	88,681	2,035,409	4,729,867	38,246	275,064	4,493,049	‡529,470
Evansville & Terre Haute.....	310	810,365	355,435	1,293,761	183,442	175,446	25,403	297,480	43,752	825,523	468,238	2,150*	63,245	402,843	3,058
Fort Worth & Rio Grande.....	196	497,684	212,468	748,685	89,467	70,415	18,974	240,455	36,361	455,672	293,013	.....	6,171	286,842	229,535
Georgia	307	1,160,927	449,360	1,713,261	337,132	234,442	57,731	700,493	50,663	1,380,461	332,800	.....	11,737	321,063	12,240
Georgia Southern & Florida.....	395	638,615	359,841	1,129,511	100,388	196,863	35,076	418,812	60,560	811,699	317,812	10,518	58,375	269,955	98,173
Kanawha & Michigan.....	177	1,120,581	196,113	1,347,902	260,517	343,940	16,657	401,545	20,005	1,042,664	305,238	130*	46,534	258,574	198,274
Louisiana Ry. & Nav. Co.....	343	490,902	77,056	612,746	166,458	79,637	21,912	273,094	36,589	577,690	35,056	.....	23,250	11,806	‡52,867
Mason City & Fort Dodge.....	386	806,374	271,586	1,145,598	132,499	156,044	12,000	480,775	5,030	786,348	359,250	3,198	44,936	317,512	‡30,093
Midland Valley.....	324	405,771	156,635	595,555	141,243	131,839	12,033	106,308	30,584	512,007	83,548	.....	52,083	31,465	‡108,866
Missouri Pacific.....	3,492	9,235,258	2,459,579	12,930,497	1,739,264	1,894,761	332,866	5,274,636	422,109	9,663,636	3,266,861	11,744*	539,735	2,715,382	318,151
Mobile, Jackson & Kansas City.....	403	686,221	186,019	930,566	142,998	107,474	11,286	288,703	61,631	612,092	318,474	.....	23,912	294,562	137,924
Nevada & California.....	379	418,432	154,380	625,436	87,197	82,021	5,802	222,207	13,889	411,116	214,320	2,284*	46,067	165,969	‡355,854
New York, Susquehanna & Western..	151	921,899	357,126	1,445,715	162,905	153,552	10,326	515,320	28,245	870,348	575,367	14,906*	74,571	485,889	17,516
Peoria & Eastern.....	352	1,122,971	412,515	1,675,226	208,005	255,058	35,522	654,326	31,890	1,184,801	490,425	.....	62,612	427,813	‡73,628
Pittsburgh & Lake Erie.....	191	6,182,449	730,271	7,132,134	866,746	635,957	91,121	1,659,961	149,175	3,402,960	3,729,174	2,140*	114,526	3,612,509	‡753,297
Quincy, Omaha & Kansas City.....	262	322,808	129,416	489,624	123,457	80,563	11,012	223,645	20,924	459,601	30,023	.....	17,660	12,363	18,393
St. Joseph & Grand Island.....	319	667,324	237,635	981,853	146,465	101,528	36,589	318,384	25,859	628,825	353,028	275	26,219	327,084	‡43,413
St. Louis & San Francisco.....	4,727	14,034,203	5,567,169	21,203,229	3,321,425	2,928,405	444,904	7,296,199	653,159	14,644,092	6,559,137	.....	897,486	5,661,651	‡238,590
St. Louis, Brownsville & Mexico.....	454	426,253	198,682	672,174	118,494	89,834	19,396	249,082	37,130	513,936	158,238	688	31,361	126,189	3,038
St. Louis, Iron Mtn. & Southern....	2,608	9,868,349	2,731,601	13,765,643	1,881,255	1,805,330	302,834	4,558,620	407,861	8,955,900	4,809,743	19,262*	444,635	4,345,846	537,106
Santa Fe, Prescott & Phoenix.....	257	537,858	186,004	770,633	130,211	64,391	16,461	182,689	32,944	426,696	343,936	.....	.....	343,936	‡49,628
Texas Central.....	268	459,666	257,881	762,759	96,197	96,835	7,102	257,252	30,172	487,558	275,201	.....	15,012	260,189	9,969
Toledo, Peoria & Western.....	248	395,316	236,659	666,108	107,588	128,539	14,553	245,188	22,865	518,733	147,375	.....	28,000	119,375	11,935
Toledo, St. Louis & Western.....	451	1,612,017	292,642	2,047,742	232,609	277,702	39,243	688,431	55,108	1,293,093	754,649	.....	80,500	674,149	‡97,753
Trinity & Brazos Valley.....	455	1,192,310	101,690	1,313,623	236,599	186,301	30,707	605,552	80,314	1,139,473	174,150	.....	22,099	152,051	432,249
Western Maryland.....	543	2,890,560	512,796	3,565,566	382,303	522,706	49,232	1,128,665	82,969	2,165,875	1,399,691	.....	115,500	1,284,191	32,572
Wisconsin, Minnesota & Pacific.....	271	291,013	108,528	430,194	88,398	44,516	2,014	155,728	2,100	292,756	137,438	62	18,631	118,869	19,161

*Deficit. †Loss. ‡Decrease.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Howard Mannington, Secretary of the Ohio Railroad Commission, has resigned to become Secretary of the Ohio Coal Operators' Association.

M. W. A. McGonegal, Vice-President and General Manager of the Duluth, Missabe & Northern, has been elected President, succeeding W. J. Olcott, resigned.

H. E. Covertson, Agent of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed a Traveling Auditor of the Peoria & Eastern, with office at Indianapolis, Ind.

R. A. Purcell, Claim Agent of the Chicago & Alton, has been appointed a Claim Agent, with office at Bloomington, Ill., succeeding J. W. Johnson, resigned to go with another road.

H. M. Atkinson, temporary Receiver of the Atlanta, Birmingham & Atlantic, and S. F. Parrott, President of the Atlantic Compress Co., have been appointed permanent Receivers of the Atlanta, Birmingham & Atlantic. Mr. Atkinson succeeds P. S. Arkwright.

Arthur Hale, of the American Railway Association, now has the title of General Agent. This title agrees well with the functions of the office, as described in our issue of January 1, last, when he was appointed. Presumably he will retain the committee chairmanships which he now exercises.

Hon. Lloyd Wheaton Bowers, General Counsel of the Chicago & North Western, has been appointed Solicitor-General of the United States, succeeding Henry M. Hoyt. Mr. Bowers was born in 1859 at Springfield, Mass. He graduated from Yale University in the class of 1879 and afterwards studied law at the Columbia Law School, receiving the degree of LL.B. in 1882. After practising law for about two years in New York he moved to Winona, Minn., where he engaged in the general practise of law. He was appointed General Counsel of the Chicago & North Western in 1893, with office at Chicago.

Chas. E. Pugh, Second Vice-President of the Pennsylvania, has been elected the First Vice-President, in charge of the pension, insurance, real estate and purchasing departments, succeeding J. P. Green, retired. J. B. Hutchinson, Assistant to the Second Vice-President, has been appointed the Assistant to the First Vice-President; Samuel Rea, Third Vice-President, has been elected the Second Vice-President, in charge of the Engineering and Accounting departments; A. J. County, Assistant to the Third Vice-President, has been appointed the Assistant to the Second Vice-President; C. M. Bunting, Assistant to the First Vice-President, has been appointed the Assistant Comptroller, with office at Philadelphia; J. B. Thayer, Fourth Vice-President, has been elected the Third Vice-President, in charge of the Traffic department, with office at Philadelphia; Henry Tatnall, Fifth Vice-President and Treasurer, has been elected the Fourth Vice-President, in charge of the company's finances; J. F. Fahnestock, Assistant Treasurer, has been elected the Treasurer.

John Pugh Green, First Vice-President of the Pennsylvania, who would have retired in July under the pension regulations, resigned previous to the regular annual election of officers. He was born in Philadelphia on July 31, 1839, and was educated in the schools of that city, graduating with honor from the high school. After graduation he took up the study of law and passed a creditable examination and was admitted to the bar in 1860. He entered the private service of Thomas A. Scott, then First Vice-President of the Pennsylvania, on January 10, 1865. He remained in that position until January 1, 1866. He later spent some time looking after Colonel Scott's interests in California, and in July, 1869, became chief clerk to Mr. Scott, which position he held until in 1874, when, Mr. Scott, having been elected President, he was promoted to the position of Assistant to the President. In October, 1882, Captain Green was made Fourth Vice-President; on June 30, 1888, Third Vice-President; on March 1, 1893, Second Vice-President, and on February 10, 1897, First Vice-President. As First Vice-President he has special supervision of the Secretary's, Treasury and Accounting departments, and of the employees' saving fund. He also assists the President, specially in matters connected with the operation and management of the railways controlled directly or indirectly by the company west of Pittsburgh, and in all matters relating to other railways in which the company may have an interest. He occupies the same position in the Northern Central, the Philadelphia, Baltimore & Washington and the West Jersey & Seashore, and is a director of the Pennsylvania Company, and of the Pittsburgh, Cincinnati, Chicago & St. Louis, and of various companies affiliated with the Pennsylvania railway system.

William W. Atterbury, General Manager of the Pennsylvania, has been elected Fifth Vice-President, in charge of transportation. He was born at New Albany, Ind., January 31, 1866. After receiving a liberal preparatory education, Mr. Atterbury was graduated from Yale University, and began railway work in 1886 as an apprentice in the Altoona shops. From 1889 to 1892 he served as assistant road foreman of engines on various divisions of the Pennsylvania and the Philadelphia, Wilmington & Baltimore. In 1892 he was promoted to Assistant Engineer of Motive Power in the Pennsylvania Company's Northwest System, and, in 1893, to Master Mechanic of the Pennsylvania Company at Fort Wayne, Ind. At this time he married Miss M. H. Hoffman, of Fort Wayne. On October 26, 1896, Mr. Atterbury was advanced to General Superintendent of Motive Power of the Pennsylvania Lines East of Pittsburgh and Erie. He was appointed General Manager of the Pennsylvania Lines East of Pittsburgh and Erie on January 1, 1903, and on March 24, 1909, he was elected Fifth Vice-President, in charge of transportation. Mr. Atterbury is a member of the Rittenhouse, Union League and many other clubs of Philadelphia, Pittsburgh, Washington and Baltimore. He is also a member of the American Academy of Political and Social Science, the American Society of Mechanical Engineers and the American Society of Civil Engineers.

W. W. Atterbury.

Operating Officers.

M. McD. Duff has been appointed the Assistant to the Manager of the steamship lines of the Canadian Pacific, with office at Montreal.

A. G. Smart has been appointed a Trainmaster of the Chicago, Burlington & Quincy, with office at McCook, Neb., succeeding G. H. Pearce, assigned to other duties.

W. H. Spice, Trainmaster of the New York Central & Hudson River at West Albany, has been appointed a Freight Agent, with office at Utica, N. Y., succeeding S. H. French.

The offices of the Superintendent, Timekeeper, Train Despatcher and Fuel Agent of the Chicago, Lake Shore & Eastern were removed on March 15 from Chicago to Gary, Ind.

F. A. Gascoygne has been appointed the Superintendent of Car Service of the Eastern lines of the Canadian Pacific, with office at Montreal. J. D. Altimas has been appointed a Car Accountant, with office at Montreal.

H. M. Carson, Assistant to the General Manager of the Pennsylvania, has been appointed the General Superintendent of the Northern Central Railway and the Erie division of the

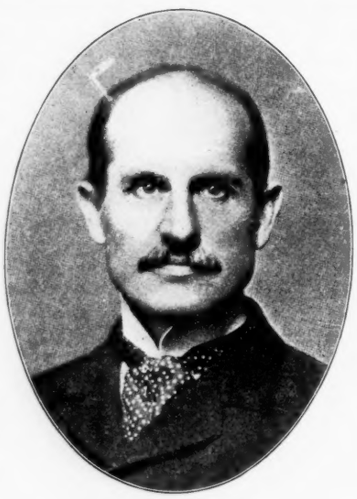
Pennsylvania, with office at Williamsport, Pa., succeeding W. H. Myers.

G. K. Jeffries, Superintendent of the Richmond division of the Terre Haute, Indianapolis & Eastern Traction, has been appointed the General Superintendent, with office at Indianapolis, Ind. Alexander Gordon succeeds Mr. Jeffries, with office at Greenfield.

James A. Boyers, whose appointment as Assistant Superintendent of the Nashville, Chattanooga & St. Louis has been announced in these columns, was born in 1853 at Nashville, Tenn. In 1871 he began railway work as a brakeman on the Nashville, Chattanooga & St. Louis, and later became conductor. After about 18 years' work as passenger conductor he was appointed Acting Trainmaster, which position he held until his present appointment.

William C. McKeown, whose appointment as the Superintendent of the Union Pacific at Cheyenne, Wyo., has been announced in these columns, was born on July 16, 1860, at Joliet, Ill. After receiving a high school education, he began railway work on January 1, 1879, as brakeman for the Union Pacific. In November, 1880, he was made a freight conductor, and in February, 1890, a passenger conductor. From March to July, 1905, he was Chairman of the Board of Examiners. In July, 1905, he was appointed Trainmaster of the Colorado division, and in May, 1906, was made the Assistant Superintendent of the Colorado division. In April, 1907, he was made the Assistant Superintendent of the Wyoming division, and on March 1, 1909, was appointed the Superintendent.

William Heyward Myers, General Superintendent of the Northern Central and the Erie division of the Pennsylvania, has been elected General Manager of the Pennsylvania, with office at Philadelphia. He was born in San Antonio, Texas, April 9, 1856, and was educated in private schools and at the School of Mines of Freiberg, Germany. He began railway work on the Pennsylvania January 17, 1876, as rodman in the office of the General Superintendent at Altoona. He was appointed Assistant Supervisor at Downingtown in June, 1876; Supervisor at Lancaster in April, 1879; Assistant Engineer of the Tyrone division in January, 1881; Assistant Engineer of the Middle division in September, 1881; Assistant Engineer of the Philadelphia division, January 1, 1884; Superintendent of the Bedford division, April 1, 1889; Superintendent of the Belvidere division, September 1, 1889; Superintendent of the Schuylkill division, January 1, 1891; Superintendent Middle division, January 1, 1899. Mr. Myers was appointed General Superintendent Philadelphia & Erie division and Northern Central on August 1, 1900. On March 24, 1909, Mr. Myers succeeded W. W. Atterbury as General Manager of the Pennsylvania.



W. H. Myers.

John G. Rodgers, Superintendent of the New York, Philadelphia & Norfolk, has been appointed the Assistant to the General Manager of the Pennsylvania, with office at Philadelphia. He was born November 14, 1862, and was educated at Lehigh University. He began railway work on the Pennsylvania in 1882. Mr. Rodgers served through the various grades in the construction department until he reached the position of Assistant Engineer of Construction, from which he was transferred on January 16, 1888, to the Altoona Maintenance of Way office. He arose through the various ranks in that department until January 1, 1900, when he resigned as Supervisor of the Philadelphia division to accept the position of Superintendent of the New York, Philadelphia & Norfolk, which position he held until his appointment on March 24, 1909, as Assistant to the General Manager of the Pennsylvania.

Traffic Officers.

F. P. Metzner has been appointed a Traveling Passenger Agent of the Vandalia, with office at Terre Haute, Ind.

R. E. Woodruff has been appointed a General Agent of the Erie, with office at Chicago, succeeding James P. Sherwin, deceased.

W. E. Steakley has been appointed a Traveling Freight Agent of the Nashville, Chattanooga & St. Louis, with office at Atlanta, Ga.

A. Baker has been appointed the Tariff Inspector of the Texas & Pacific and the Denison & Pacific Suburban, with office at Dallas, Tex. This is a new position.

H. J. Owens, Commercial Freight Agent of the Missouri Pacific-Iron Mountain System at Dallas, Tex., has resigned, effective April 1, to engage in private business.

Z. T. George, Traveling Freight and Passenger Agent of the Wabash, has been appointed a General Agent, with office at San Francisco, Cal., succeeding C. S. Orcutt, resigned.

J. F. Hennessey has been appointed a Traveling Freight and Passenger Agent of the Ft. Smith & Western and the St. Louis, El Reno & Western, with office at Ft. Smith, Ark.

John E. Henderson, Traveling Freight Agent of the Chicago, Indiana & Southern, has been appointed an Agent of the North & South Despatch, with office at Detroit, Mich. Edward W. Sievert succeeds Mr. Henderson, with office at Chicago.

J. J. Puller, whose resignation as Assistant General Passenger Agent of the Seaboard Air Line has been announced in these columns, has been appointed Sales Manager of the Pittsburgh Screw & Bolt Co., Pittsburgh, Pa., with office in Pittsburgh.

David O. Ives, Chairman of the Official Classification Committee of the Trunk Line Association, has been appointed Secretary of the New England Board of Trade and Transportation, effective May 1. He has been with the Official Classification Committee but a little less than a year.

W. G. Knittle, General Agent, Passenger department, of the Cleveland, Cincinnati, Chicago & St. Louis, at Cincinnati, Ohio, has been transferred to Grand Rapids, Mich., succeeding H. R. Daly, who is transferred to Indianapolis, Ind., succeeding C. C. Clark, who succeeds Mr. Knittle.

F. E. Ayers, Contracting Freight Agent of the North and South Despatch at Chicago, Ill., has been appointed an Agent, with office at Indianapolis, Ind. J. D. Pierce succeeds Mr. Ayers, with office at Chicago. John E. Henderson has been appointed an Agent, with office at Detroit, Mich.

Charles W. Fish, whose appointment as General Freight Agent of the National Railways of Mexico was previously announced in these columns, was born in 1863, in Natchez, Miss. After a public school education in Girard, Ill., he began railway work in 1882 as a telegraph operator on the Missouri Pacific. He was later a clerk and then traveling accountant. In January, 1888, he was made Traffic Manager and Local Agent of the International & Great Northern, and six years later became General Freight and Passenger Agent of the Texas Mexican; and also Commercial Agent of the National of Mexico. In 1901 he was made Assistant Auditor of the National Railroad of Mexico, and in May of that year was made Auditor. In May, 1904, he was appointed General Freight Agent of the National Lines of Mexico, which position he held until his recent appointment.

Engineering and Rolling Stock Officers.

E. J. Bohanon has been appointed a Roadmaster of the Chicago, Rock Island & Pacific, with office at Little Rock, Ark., succeeding Austin Ball, resigned.

J. B. Berry, the Chief Engineer of the Chicago, Rock Island & Pacific and the Supervising Engineer of the St. Louis & San Francisco, has been appointed also the Supervising Engi-

neer of the Colorado Southern, New Orleans & Pacific. M. C. Byers, the Chief Engineer of the St. Louis & San Francisco, has been appointed also the Chief Engineer of the Colorado Southern, N. O. & P., succeeding C. H. Fisk, resigned.

The offices of the Roadmaster and the Assistant Superintendent of Bridges and Buildings of the Chicago, Lake Shore & Eastern, were removed, on March 15, to Gary, Ind.

George Boyce has been appointed the Superintendent of Telegraph and Signals of the Chicago, St. Paul, Minneapolis & Omaha, with office at St. Paul, Minn., succeeding Henry C. Hope, deceased.

W. H. Foster, Master Mechanic of the New York Central & Hudson River, in charge of the Harlem division, with office at North White Plains, N. Y., has been transferred as Master Mechanic to High Bridge and put in charge of the Hudson and the New York & Putnam divisions, succeeding L. H. Raymond, resigned. H. B. Whipple succeeds Mr. Foster, with office at North White Plains. W. A. Deems has been appointed a Master Mechanic, with office at Tupper Lake, N. Y.

OBITUARY.

B. B. Linn, an Attorney and for a number of years a Claim Agent of the Nashville, Chattanooga & St. Louis, died on March 18, at Paducah, Ky. He was 65 years old.

Maricus C. Woodruff, Right of Way Commissioner and a Claim Agent of the Chicago Great Western, died on March 19 at Dubuque, Ia. He was formerly editor and publisher of the *Dubuque Times* and a member of the Iowa State Railroad Commission. He was 78 years of age.

William S. Taylor, President of the Fentress Coal & Coke Co. of Philadelphia, and formerly identified with a number of railway enterprises, died March 12 at Philadelphia. He was at one time Treasurer of the Kansas City Southern and was for some time President of the Kansas City, Fort Scott & Southern.

H. B. Hamblin, General Freight Agent of the Chicago, Burlington & Quincy, died at Pasadena, Cal., on March 23. He began railway work in 1875 as Agent on the Burlington & Missouri, now part of the Chicago, Burlington & Quincy, at Lincoln, Neb. In 1882 he became General Agent at Omaha, and in 1886 was made General Freight Agent of the Chicago, Burlington & Northern, now part of the Burlington. Four years later he was made Assistant General Freight Agent of the Chicago, Burlington & Quincy, with office at Chicago. On February 20, 1905, he was made General Freight Agent of the Illinois and Iowa districts, and was later appointed General Freight Agent.

Prince Michael Khilkoff, a member of the Council of the Empire of Russia, and formerly Minister of Communications, died suddenly at St. Petersburg on March 21. Prince Khilkoff, who belonged to an old but comparatively poor family, emigrated to the United States when a young man, renouncing the title to which he was subsequently restored. In the United States he worked at a bolt machine at $7.50 a week. Later he was employed in many minor capacities on American railways, beginning as an assistant stoker. Some years later he returned to Russia and was appointed Minister of Railways. The prince, in his ministerial capacity, visited the United States in 1896. When the Russo-Japanese war broke out, in 1904, predictions that Japan might be victorious in the struggle were based chiefly on the fact that the Siberian railway was a single-track line and that it would be unable to transport a necessary number of men to the Far East and supply them after their arrival with ammunition and equipment. He assumed personal charge of the railway operations. A large part of the ill-constructed line was double tracked under his administration, trains ran on their schedules, and at the time of the Peace of Portsmouth over a million Russians, well equipped, were lined up against their opponents on the line from Kwen-Tu-Ling to Kirin. Prince Khilkoff took a prominent part in putting down the railway strike in 1905, but resigned his office in the fall of that year because the government failed to meet the promises made to the railway employees, his resignation being accepted on November 8. He was then appointed a member of the Council of the Empire.

Alfred B. Farnsworth died in Grand Rapids, Mich., March 7. He was for many years General Eastern Passenger Agent of the Chicago, Rock Island & Pacific Railway in New York.

Alfred B. Farnsworth.

To those whose experience extends back to before there was an agreed distribution of the immigrant business among the lines, before the Trunk Line commissions, and long before the interstate commerce act, there will come with the mention of A. B. Farnsworth's name a lively recollection of the spirited competition and battles fought along lower Broadway, and at old Castle Garden over the securing of this traffic. In those days Mr. Farnsworth was always to be found in the forefront. Strong, vigorous, energetic, resourceful, always courteous, but firm as a rock—he had a strength that few could resist. But with a disposition to fight for business he combined a geniality, a spirit of fairness, and a companionable, loyal good-fellowship, which won for him the respect and affection of his strongest business antagonists. A close personal friendship existed between him and the late E. St. John, for many years in charge of the passenger traffic and later General Manager of the Rock Island road. When Mr. St. John left the road to assume the management of the Seaboard Air Line, Mr. Farnsworth for a time went with him, but he shortly returned to the Rock Island and became identified with the industrial and immigrant departments of the system, where he was prominent in the development of the famous Oklahoma district of the southwest. A few years ago he retired from business and returned with his family to Grand Rapids, the home of his youth. Mr. Farnsworth was born in Detroit 65 years ago. He leaves a wife and one daughter, Mrs. H. H. Atkinson, of Grand Rapids.

John H. Starin, head of the Starin City, River & Harbor Transportation Line, died at his home in New York, March 22. He was born in Samsonsville, N. Y., in 1823, and after studying medicine, came to New York. He soon abandoned medicine and became engaged in the drug business. Later he was appointed, through the friendship of Commodore Vanderbilt, a Soliciting Freight Agent of the Hudson River Railroad, now part of the New York Central & Hudson River. At the time of his appointment there were no car floats for the transfer of freight cars around New York harbor. Mr. Starin soon became engaged in the lighterage business, and after building his own shipyards at Staten Island, began to use car floats for the transportation of loaded and empty freight cars around New York city. During the civil war he did a large transport business for the government, and after the war became one of the largest owners of tugs and car floats in New York. He was well known for his excursion barges, and was the owner of Glen Island, a popular summer resort in Long Island Sound. Mr. Starin was twice elected to Congress, and was at one time a candidate for governor. He was a member of a number of clubs, including the Union League and the New York Yacht. He was also at one time a member of the Chamber of Commerce and opposed the extension of elevated lines, being a strong advocate of subways. At the time of his death he was in control of the freight lighterage business in New York harbor of the New York Central & Hudson River, Morris & Essex Railroad, the Delaware, Lackawanna & Western, and the Central of New Jersey. He is survived by two daughters and one son.

Railroad Construction.

New Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—Authorization has been given for the double-tracking of the line between Wyaconda, Mo., and Bucklin, 69 miles. Company expects to complete also this year about 50 miles of double track on the Illinois and Missouri divisions.

The Belen cut-off, from Texico, N. Mex., west to Belen, has been opened for operation.

Baltimore & Ohio Southwestern.—Reports from Mitchell, Ind., indicate that new rails are being placed between that place and Tunnellton.

British Columbia, Alberta, Saskatchewan & Manitoba.—See St. Mary's & Crawford Bay.

Buffalo, Rochester & Eastern.—The New York Public Service Commission, Second district, has refused to issue a certificate of necessity to this company, organized in 1907 to build from Buffalo, N. Y., east to Rochester, and thence to Troy, about 300 miles. See item in reference to this company under New York State Commission.

Calumet Traction.—Incorporated in Indiana with $100,000 capital to build from Hammond, Ind., east via East Chicago and North Calumet to various towns in Lake county. The headquarters of the company will be in Hammond. The directors include W. J. Reilly, East Chicago; W. P. Ijams, Terre Haute, and E. J. Keating, Hammond.

Canadian, Liverpool & Western.—Incorporation is being asked to build east and west across the Province of Quebec to a connection with the Grand Trunk Pacific and to some point on the Atlantic coast. The incorporators include: G. McClenahan, Montreal; T. B. Rankin, G. S. May, W. Johnson and D. G. Stewart, of Ottawa.

Canadian Northern.—The Manitoba Government has agreed to guarantee bonds of this company for $13,000 a mile for the following lines: From its line near Hallboro, Man., westerly or northwesterly, 110 miles; from a point near Oak Point, northerly, 50 miles; from a point near Makinak, northerly and northwesterly, 50 miles.

Canadian Pacific.—The following improvements will be made during the present year on the western lines: New terminal yards at Moose Jaw, Sask., $150,000; steel bridges at Wardner, B. C., and Elko, $200,000; 19 large wooden trestles in the vicinity of McLeod, Alb.

Chicago, Cincinnati & Louisville.—See item regarding this company under State Commissions.

Chicago, Milwaukee & Puget Sound.—This company has sold to the Union Pacific Company a half interest in its line from Black River Junction, Wash., to a crossing of the Puyallup river, three miles from Tacoma, about 26 miles. The companies will jointly build a line about 100 miles long from a point near Tacoma to Gray's Harbor on the Pacific.

Chihuahua & Pacific.—See Mexico North Western.

Cleveland, Cincinnati, Chicago & St. Louis.—According to press reports, work is to begin on the Evansville, Mt. Carmel & Northern, from Mt. Carmel, Ill., south to Evansville, Ind., 43 miles.

Cleveland Short Line.—See Lake Shore & Michigan Southern.

Christiana & Coatesville (Electric).—This is the new name of the Philadelphia, Coatesville & Lancaster, operating 20 miles in Pennsylvania. Company was recently organized, with $400,000 capital. It is the intention to build an extension from Christiana, Pa., east to Parkesburg, 5 miles.

Crow's Nest & Northern.—An officer writes regarding building from Crow's Nest, B. C., north along the north fork of Michel creek, 15 miles, that contracts for grading, track laying, bridges, etc., will be let about July, 1909. The work will include about 245,000 cu. yds. of excavation, the building of two Howe truss bridges and nine framed trestles. (March 5, p. 480.)

Cumberland & Northern.—Incorporated in Kentucky, with $100,000 capital, to build from Artemus, Knox county, Ky., north to Beattyville, about 75 miles. J. H. Gresham, Pres.; S. P. Condon, Vice-Pres., and E. L. Thomas, Sec. and Treas., all of Knoxville, Tenn.

Evansville, Mt. Carmel & Northern.—See Cleveland, Cincinnati, Chicago & St. Louis.

Gilmore & Pittsburg.—MacArthur Bros. Construction Co., New York, has been awarded a contract for building this line from Armstead, Mont., west to Salmon City, Idaho, with a 20-mile branch from Junction, Idaho, northwest to Gilmore, about 120 miles in all. There will be about 2,500,000 cu. yds. of excavation work exclusive of the 750-ft. tunnel.

Girard Coal Belt.—See Pittsburg & Kansas City (Electric).

Gulf Line.—An officer writes regarding the proposed extension from Bridgeboro, Ga., southwest to Camilla, that surveys have been made, but financial arrangements are not yet complete. (March 12, p. 524.)

Indianapolis, New Castle & Toledo (Electric).—Bids soon to be asked for building portion of line between Indianapolis, Ind., and New Castle, to cost about $450,000.

Interoceanic.—Preparatory to widening the gage, a number of cut-offs will be built between Mexico City, Mex., and Vera Cruz. Work on one of the most important of these cut-offs, from Rubin, V. C., to Vigas, was started over a year ago and will soon be completed. New steel bridges are also being placed.

Kansas City, Kansas & Southwestern (Electric).—Projected from Topeka, Kan., east to Kansas City. Press reports indicate that bids for fencing, culverts, cement work, etc., have been received. E. M. Lampkin, of the Marlin Construction Co., President, Kansas City, Mo.

Lake Erie & Pittsburg.—See Lake Shore & Michigan Southern.

Lake Shore & Michigan Southern.—An officer writes that the Lake Erie & Pittsburg is being built from a junction with the Cleveland Short Line near Newburg, Ohio, to a connection with the Pennsylvania Lines West, at a point west of Ravenna. The line is expected to be open for operation this fall. The Cleveland Short Line will be open for operation about the same time to a junction with the L. S. & M. S. west of West Park, Ohio. These improvements, when finished, will provide a line from Lorain, Ohio, via Elyria over the L. S. & M. S., the C. S. L., L. E. & P., Pennsylvania, B. & O., and the P. Y. & A., to Youngstown, Ohio.

Lake Superior & Long Lake Railway & Transportation Company.—This company has applied for a charter to build from Black River Siding, Ont., on the Canadian Pacific, to Owl lake. It is the intention to operate steamers on Owl lake, also to build from the northerly end to Long lake, and operate steamers on that lake to a connection with the National Transcontinental (Grand Trunk Pacific). The line is to carry contractors' supplies for Davis & Sons, of Ottawa, who have contracts for 200 miles of work on the National Transcontinental. R. A. Pringle, Solicitor, Cornwall, Ont. (March 12, p. 524.)

Louisiana & Arkansas.—Press reports say that surveys are now being made for a branch from Minden, La., west to Shreveport, 30 miles. It is expected to have the work finished this fall.

Manufacturers' Railway.—An officer writes regarding the plan of enlarging the terminal facilities at St. Louis, Mo., that work is under way locating a number of delivery yards for use of the general public. The present yard capacity is about 1,200 cars, which is to be doubled. (March 12, p. 524.)

Mexico North Western.—Incorporated in Canada as the Mexican Transportation Co., with $1,000,000 capital stock, later changed name to Mexico Transportation Co. and increased its authorized share capital to $40,000,000. Application has been made to the Canadian Parliament to again change the name to the Mexico North Western. The company is acquiring control of the Chihuahua & Pacific, extending from Tabalaopo, Mex., west to Minaca, 200 miles, and

from La Junta northwest to Temosachic, 87 miles; also the Sierra Madre & Pacific, extending from Temosachic, Mex., to the Madera, 32 miles, making a total of 319 miles. The company intends, in the immediate future, to acquire further lines and build a number of extensions amounting to about 402 miles, which it is expected will be in operation by January 1, 1911, making the total mileage of the two railways about 721 miles. One terminal will be at El Paso, Tex., and the other at Chihuahua, Mex.

MONTANA, WYOMING & SOUTHERN.—An officer writes that construction will begin April 1 on the 163 miles from Sheridan, Wyo., northeast to Miles City, Mont., and that contracts will be let at once. The work will include 6 steel bridges. T. J. Robb, Ch. Engr., Sheridan. (February 19, p. 381.)

NATIONAL RAILWAYS OF MEXICO.—Reports from Mexico City indicate that the first of a number of cut-offs planned will be built between Metepec, Tlaxcala, Mex., and San Lorenzo, about 28 miles. Surveys have been made and plans are now awaiting government approval. The roadbed will be built so as to permit future widening of the gage.

NEW YORK CENTRAL & HUDSON RIVER.—Double-tracking the Rome, Watertown & Ogdensburg division, between Utica, N. Y., and Stittville, 10.2 miles, is now under way. Final decision has not yet been reached regarding similar work between Richland and Lacona, six miles, and between Watertown and Adams, 15 miles.

OKLAHOMA & GOLDEN CITY.—Surveys now under way between Golden City, Mo., and Stockton. On completion of this section work will begin southwest from Golden City. (March 19, p. 656.)

OKLAHOMA, VERNON & PACIFIC.—Incorporated with $125,000 capital stock to build from Vernon, Tex., southwest to Eastacado, 125 miles. Surveys made. Connection will be made with the St. Louis & San Francisco at Vernon. Incorporators include: L. G. Hawkins, B. J. Parker, T. J. Youngblood, D. J. Gibbs and B. Housels, all of Vernon.

PENNSYLVANIA.—See item regarding this company under State Commissions.

PHILADELPHIA, COATESVILLE & LANCASTER (ELECTRIC).—See Christiana & Coatesville.

PITTSBURG & KANSAS CITY (ELECTRIC).—An officer writes that this company has bought the property of the Girard Coal Belt Railway Co., including a 12-mile line, connecting Girard, Kan., Dunlap, Franklin and Croweburg. The new owners propose to connect this line with the Joplin & Pittsburg Railway, at Pittsburg, Kan., and build an additional 20 miles to connect Mulberry, Burgess and Curranville. When these improvements are finished, it will provide an interurban service in Missouri to Carthage, Joplin and Webb City, and in Kansas to Galena, Columbus, Weir City, Cherokee, Pittsburg and Girard. J. W. Ground, President, 311 First National Bank building, Kansas City, Mo., and W. W. Calhoun, Secretary, Carthage, Mo.

ROSCOE, SNYDER & PACIFIC.—An officer writes that grading is completed on the 19-mile extension northwest from Snyder, Tex., and that track laying will begin this spring. (Dec. 13, p. 1650.)

SAN DIEGO, EL PASO & ST. LOUIS.—An officer writes that the New Mexico corporation, capitalized at $4,000,000, is now making surveys in New Mexico from El Paso, Tex., northeast through New Mexico. A. Courchesne, President; H. B. Stevens, Vice-President, and L. P. Atwood, Ch. Engr., El Paso, Tex., are of the New Mexico corporation. (Feb. 26, p. 436.)

ST. MARY'S & CRAWFORD BAY.—Application is being made to the Dominion parliament for power to change the name of this company to the British Columbia, Alberta, Saskatchewan & Manitoba, and for an extension of time in which to build between Hartney, Man., and the Pacific coast, about 1,600 miles.

SIERRA MADRE & PACIFIC.—See Mexico North Western.

SUNBURY, LEWISBURG & MILTON (ELECTRIC).—Being organized by people identified with the York Bridge Co., York, Pa., which already controls the new Sunbury & Selingsgrove electric lines and the new bridge over the Susquehanna river from Sunbury, Pa., to Shamokin Dam. An officer writes that the company proposes to build from a connection with the S. & S. at the western end of the bridge, north through Winfield and Lewisburg to Milton, about 15 miles. B. A. Musser, Sec., Selingsgrove, Pa.

UNION PACIFIC.—See Chicago, Milwaukee & Puget Sound.

VALLEY ELECTRIC.—Organized in Oregon to build into the Mount Hood country. E. T. Folts, Pres.; A. M. Kelley, Vice-Pres., and H. B. Langville, Sec., Hood River, Ore.

WABASH.—Press reports say that this company has submitted new plans for track elevation work in Fort Wayne, Ind. As soon as the plans are approved by the city authorities it is expected work will be begun.

WAYNESBURG & MONONGAHELA.—Press reports say that a contract has been given to a New York contractor, and work is to begin at once on the projected line from Waynesburg, Pa., north to Monongahela, 30 miles. P. Langsdorf, Pres.; C. Koehler, Treas., both of McKeesport, Pa.; J. C. Sheldon, Sec., Buffalo, N. Y.; W. J. Sheldon, Vice-Pres. and Gen. Mgr., Waynesburg.

Railroad Financial News.

ATCHISON, TOPEKA & SANTA FE.—After numerous unofficial statements that the company was about to issue $25,000,000 additional convertible bonds, Walker D. Hines, acting chairman of the executive committee, on March 17 made the following explanation:

"Some time ago the company began the consideration of a plan to issue additional convertible bonds with the view of raising new capital while market conditions were favorable, although the company had no immediate need for the money. After the details of the plan had been decided on, it was learned that the legislature of Kansas, under the laws of which the company is incorporated, had passed a stock and bond act regulating future capital issues. While this act has not yet taken effect and would not have applied to the contemplated issue if made at once, yet after deliberation it was decided that it was not advisable to make the issue on the eve of the act taking effect, but that it was preferable to postpone the entire matter and at some convenient time make application to the Kansas Board of Railroad Commissioners for the certificate contemplated by the new act."

CHICAGO & MILWAUKEE ELECTRIC.—A decree of foreclosure has been entered against the company's property in Milwaukee county in favor of George Rockwell, and the Rockwell lien is placed ahead of that of the Metropolitan Trust Co., of Chicago, which brought foreclosure proceedings some time ago.

CHICAGO GREAT WESTERN.—*The Commercial and Financial Chronicle*, New York, publishes the following tentative plan of reorganization:

Proposed Authorized Issues.

First mortgage 50-year 4 per cent. authorized issue	$60,000,000
Reserved to retire M. C. & Ft. D. 4s	$12,000,000
Reserved to retire W., M. & P. Div. 4s	5,811,000
Immediate issue to be sold to provide for payment of claims, improvements, etc.	15,000,000
Reserved for future purposes, possibly	27,189,000
New preferred stock issue limited to	Not stated.
Issuable to retire present debenture stock at 110	$30,940,000
For assessments on preferred V and common stock	10,135,000
New common stock, limited to	Not stated.
Issuable in exchange for present stock (common and A and B preferred) on payment of assessments	$44,252,000

Proposed Terms of Exchange.

Holders of each $100 of	To pay assessm't.	Receive new stock— Preferred.	Common.
Debenture stock ($28,127,000)	None.	$100	....
Preferred A ($11,336,900)	None.	....	$120
Preferred B ($23,104,000)	$15	15	60
Common stock ($44,465,000)	15	15	40

CHIHUAHUA & PACIFIC.—See Mexico North Western.

GRAND TRUNK PACIFIC.—The company has asked the government of Canada to advance $10,000,000 on the security of the 4 per cent. bonds of the Grand Trunk Pacific. An officer of the company says that the government has been asked to act

as banker, so as to save the discount that would be a loss to the company if the bonds were sold in London just at present.

Metropolitan Street Railway (New York).—Judge Lacombe in the United States Circuit court on March 18 signed the foreclosure decree under the general collateral trust mortgage securing $12,000,000 bonds. The principal and interest due under the mortgage amounts to $13,589,271. The sale of the property is set for June 1.

Mexican Transportation Co.—See Mexico North Western.

Mexico North Western.—The Mexican Transportation Co., incorporated in Canada February 18, 1909, with $1,000,000 stock, has changed its name to the Mexico Transportation Co. and increased its authorized stock to $40,000,000, of which $15,000,000 has been issued. An application is to be made to the Canadian parliament to change the name to the Mexico North Western, and also to empower the company to guarantee the bonds and stocks of any corporation the majority of whose capital stock is controlled by it. First mortgage 50-year, 5 per cent. bonds, amounting to £3,000,000 ($15,000,000) have been issued, and the Bank of Scotland in London, England, have received subscriptions at 90 for £2,400,000 ($12,000,000). The amount authorized to be issued of these bonds is £5,000,000 ($25,000,000).

Through the purchase of both $2,860,000 stock and $2,360,000 bonds, the new company has acquired control of the Chihuahua & Pacific, operating 287 miles in all and extending from Chihuahua to Minaca and to Temoschic. The company has also acquired control of the Sierre Madre & Pacific, which runs from Temosachic to Madera, 32 miles. For further particulars see this company under Construction.

Mexico Transportation Co.—See Mexico North Western.

National Railroad of Mexico.—The $10,000,000 5 per cent. collateral notes of 1903-1909 are to be paid at the office of Speyer & Co., New York, on April 1.

New York & Harlem.—The semi-annual dividend usually paid on April 1 from the rental paid by the Metropolitan Street Railway under its lease of the street railway division of the New York & Harlem has not been declared. The New York & Harlem owns 136 miles of road extending from Chatham, N. Y., to New York City, this road being leased to the New York Central & Hudson River for 401 years, the lease dated 1873. The N. Y. & H. also owns the Fourth Avenue Street Railway of New York City and in 1896 leased its street railway property to the Metropolitan Street Railway for 999 years. For some years past the Metropolitan has contested certain franchise taxes amounting now, it is said, to about $800,000. The non-payment of a dividend by the N. Y. & H. is because of the possibility, it is understood, of the Metropolitan being forced to abandon its lease and thus possibly make the N. Y. & H. responsible for the accumulated taxes. The semi-annual dividend of 5 per cent. payable in January and July from the rental paid by the New York Central & Hudson River is in no way affected by the present action of the N. Y. & H.

New York Central & Hudson River.—See item in regard to the Buffalo, Rochester & Eastern, under State Commissions.

New York State Railways.—Articles of incorporation have been filed with the Secretary of New York State for this company, which is to operate the electric railways owned by by the New York Central & Hudson River, in New York. The capital is given as $23,140,200. (Jan. 8, page 90.)

Pennsylvania.—The stockholders, on March 23, voted to give the Board of Directors, at their discretion, authority to increase the bonded indebtedness of the company to the extent of $80,000,000.

Sierra Madre & Pacific.—See Mexico North Western.

Wheeling & Lake Erie.—The receiver has asked Judge Taylor in the United States Circuit court for permission to sell $1,429,976 receiver's certificates to provide for the rehabilitation of the property. If permission is granted, the receiver is to sell $750,000 at once and hold the remainder until July 1.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Louisiana & Pacific has ordered 3 locomotives from the Baldwin Locomotive Works.

The Crow's Nest & Northern will be in the market this summer for a number of locomotives.

The Pacific Lumber Company, San Francisco, Cal., has ordered one locomotive from the Baldwin Locomotive Works.

The Iowa Central, reported in the *Railroad Age Gazette* of February 5 as asking prices on 12 locomotives, has ordered this equipment from the Baldwin Locomotive Works.

The Minneapolis & St. Louis, reported in the *Railroad Age Gazette* of January 22 as later to be in the market for from 10 to 14 locomotives, has ordered 14 from the Baldwin Locomotive Works.

CAR BUILDING.

The Milwaukee Northern will soon be in the market for 4 interurban cars.

The Chicago & Milwaukee (Electric) is in the market for 12 pay-as-you-enter cars.

The Crow's Nest & Northern will be in the market this summer for a number of cars.

The Conestoga Traction Co., Lancaster, Pa., has ordered 18 interurban cars from the J. G. Brill Co.

The Atchison, Topeka & Santa Fe has ordered 9 baggage and 4 coaches from the Pullman Company.

The Chicago, Indianapolis & Louisville has ordered 5 coaches from the Jeffersonville plant of the American Car & Foundry Co.

The United States Express Co. has had plans for 25 refrigerator and 10 horse cars prepared by the engineering department of the C. R. I. & P. D. H. Rawson, Supt., Chicago, will place the order.

The Southern, reported in the *Railroad Age Gazette* of March 19 as asking prices on 114 passenger cars, will divide this equipment as follows: 85 passenger coaches, 6 baggage-express, 6 mail-baggage, 6 passenger-baggage, 6 postal, 2 dining and 3 chair cars.

The Omaha & Council Bluffs Street Railway, Omaha, Neb., reported in the *Railroad Age Gazette* of January 22 as preparing specifications for 25 large cars, a portion of which would be built in company's shops, has ordered the building of 15 cars in its own shops and 10 cars from the American Car Co.

The Missouri, Kansas & Texas is asking prices on 7 thirty-ton ventilated box cars; 50 thirty-ton stock cars; 78 fifty-ton steel underframe flat cars; 111 fifty-ton steel underframe gondola cars; 13 refrigerator cars for passenger service; 13 thirty-ton, 40-ft. refrigerator cars; 18 fifty-ton steel underframe Hart convertible cars; 8 forty-ton side dump ballast cars; 40 thirty-ton furniture cars; 459 thirty-ton box cars and 19 cabooses.

IRON AND STEEL.

The Cuba Railroad is in the market for 16,000 tons of rails.

The Atlantic Coast Line is reported to be considering rail purchases.

The Michigan Central is said to be in the market for 1,500 tons of bridge material.

The Missouri Pacific is said to be in the market for 4,000 tons of structural steel.

The Marshall & East Texas has ordered 2,000 tons of rails from the Illinois Steel Co.

The Manistee & Northeastern has ordered 4,000 tons of rails from the Illinois Steel Co.

The Pennsylvania is said to have ordered 10,000 steel wheels from the Carnegie Steel Co.

The Boston & Maine has ordered 510 tons of structural steel from the Boston Bridge Co.

The Northern Pacific is reported to be receiving bids on 2,500 tons of bridge material.

The Chicago Traction Co. is said to have ordered 30,000 steel wheels from the Carnegie Steel Co.

The Florida & East Coast is said to be in the market for 100 bridge spans and a quantity of rails.

The Harriman Lines are reported making inquiries for 13,000 tons of rails for the lines in Mexico.

The Baltimore & Ohio is said to have ordered 180 tons of structural steel from the McClintic-Marshall Construction Co.

The Grand Trunk Pacific has ordered 105,695 tons of rails from the Dominion Iron & Steel Co., and 69,123 tons from the Algoma Steel Co.

The Pennsylvania has ordered 2,400 tons of steel for use in track elevation at Chicago, and 6,500 tons for similar work in Philadelphia from the American Bridge Co.

The Chicago & Alton, reported in the *Railroad Age Gazette* of March 12 as being in the market for 9,000 tons of rails, has ordered 2,500 tons from the Illinois Steel Co.

The Great Northern, reported in the *Railroad Age Gazette* of March 19 as being in the market for 2,000 tons of structural steel, has placed this order with the American Bridge Co.

The Chicago Railways Co., reported in the *Railroad Age Gazette* of March 19 as being in the market for 500 tons of structural steel, has placed this order with the American Bridge Co.

The Northern Pacific, reported in the *Railroad Age Gazette* of March 19 as being in the market for from 3,000 to 5,000 tons of structural steel, has ordered 8,000 tons from the American Bridge Co.

The Chesapeake & Ohio, reported in the *Railroad Age Gazette* of March 12 as having ordered 500 tons of bridge steel from the Pennsylvania Steel Co., will use this material for the first, second and third crossings of Mud river on the line between St. Albans, W. Va., and Barboursville.

General Conditions in Steel.—There is probably no one question so talked of now in steel circles as the proposed tariff changes. One manufacturer is quoted as having said that the reduction in steel duties would serve to prevent any immediate recovery in prices from the present level. There seems to be a general feeling that the proposed cuts are radical and that they will be lessened before the bill is finally passed. It is thought that the proposed reduction of the duty on rails, if it be passed at the present figure, will lead to a demand for lowering the price of rails for domestic consumption. It is interesting in this connection to note that the Dominion Iron & Steel Company received the order for 15,000 tons of A. M. C. E. section rails for the Grand Trunk Pacific, the best British bid being reported at $34, exclusive of duty.

RAILROAD STRUCTURES.

AMARILLO, TEX.—Plans are being prepared by the Gulf, Colorado & Santa Fe for a two-story office building to have dimensions of 40 ft. x 80 ft. The building is to provide headquarters for the new General Manager, C. W. Kouns, and his staff, and will cost $25,000.

ATCHISON, KAN.—The Missouri Pacific has prepared plans for enlarging the Central Branch shops at Atchison. Work will begin early in the spring. The additions will cost $100,000.

BARTLESVILLE, OKLA.—The Atchison, Topeka & Santa Fe is preparing plans for a new passenger station to cost $25,000.

BRANDON, MAN.—Sealed bids for a six-stall roundhouse will be received by Frank Lee, Div. Engr., Canadian Pacific, Winnipeg, until March 10.

EDMONTON, ALB.—The Canadian Pacific and the City Council are said to have plans ready for building a combined highway and railway bridge to cost about $300,000. Mayor Lee may be addressed.

JERSEY CITY, N. J.—See item on Lehigh Valley freight piers in another column.

LOUISVILLE, KY.—The union passenger station at Seventh street and the Ohio river was destroyed by fire on March 18. It is likely that a new structure will be built at once. The estimated loss is $400,000.

MONTREAL, QUE.—Press reports from Montreal, Que., indicate the proposed formation of a union terminal company and the erection of a union passenger station.

Press reports indicate that the Canadian Pacific has planned enlarging its shops.

ST. BONIFACE, MAN.—Bids will be received by P. E. Ryan, Sec., Transcontinental Railway Commission, Ottawa, until April 8, for building a steel and concrete bridge and approach spans over the Red river. Contractors will submit separate bids for sub-structure and superstructure work. Plans and specifications may be obtained at the offices of S. R. Poulin, Dist. Engr., St. Boniface, Man., and H. D. Lumsden, Ch. Engr., Ottawa.

VANCOUVER, B. C.—The Canadian Pacific is said to be planning to build car and locomotive shops.

WICHITA, KAN.—The Atchison, Topeka & Santa Fe is said to have plans ready for a new passenger station. It is to be of concrete construction, one story high, 48 ft. x 222 ft.

WINNIPEG, MAN.—Bids are wanted April 8 by P. E. Ryan, Secretary of the Transcontinental Railway Commission, Ottawa, Ont., for building a steel bridge over the Red river.

Supply Trade News.

The Union Switch & Signal Co., Swissvale, Pa., has declared a regular quarterly dividend of 3 per cent., payable April 10.

J. J. Puller, until recently Assistant General Passenger Agent of the Seaboard Air Line, has become Sales Manager of the Pittsburgh Screw & Bolt Co., Pittsburgh, Pa.

The St. John Construction Co., Chicago, has been incorporated with a capital of $50,000 to construct railways, etc. The incorporators are E. M. St. John, A. G. St. John and H. C. St. John.

The Taylor Safety Rail Co., Pine Bluff, Ark., has been incorporated with a capital of $25,000. The incorporators are: L. T. Salee, A. W. Troupe, B. P. Taylor and A. A. Lelurin.

Wilhelm Schmidt's superheating system is now in use on 4,034 locomotives on 108 railways. In our review on Mr. Garbe's book, "Die Dampflokomtiven der Gegenwart" (page 198, Jan. 29), the number was given as 2,700.

The Ernst Wiener Co., New York, reports, among the most recent orders, one for a narrow-gage railway in Columbia, S. A., consisting of over six miles of track, the necessary switches, a number of freight and passenger cars and two locomotives.

The Electric Welding Co., Pittsburgh, Pa., has taken over the sole agency of the Cummings system of steel reinforcement for reinforced concrete formerly held by Goff-Horner & Co., Frick building, Pittsburgh. In addition, it will also handle the Dudley deformed bar.

William P. Henszey, a member of the firm of Burnham, Williams & Co., Philadelphia, Pa., proprietors of the Baldwin Locomotive Works, and one of the best known designers of locomotives in the world, died of pneumonia on March 23 at his home in Philadelphia. He was 77 years old.

The Eureka continuous crossing described on page 676 of the *Railroad Age Gazette* of March 19 is made by the Central Railway Equipment Co., Canton, Ohio. An officer of the Wheeling & Lake Erie, in whose Canton yards one of these crossings has been installed, recently told the manufacturers that there had been no trouble with it, even during a snowstorm.

Fire destroyed a portion of the works of the Wright Wire Co., Worcester, Mass., on March 20, but it will be able to take care of orders as it has large, complete stocks located in buildings not reached by fire, and at various warehouses at other points. It will also operate overtime at the Palmer factories and expects the early resumption of several departments at Worcester.

The Isthmian Canal Commission is asking bids in Circular 497-C until March 19 for engine test instruments and miscellaneous articles, including small tools, pipe fittings, etc. In Circular 498-A bids are asked until March 24 for cement hoppers, cement screens and pumps; in Circular 497-A, until March 25, for repair parts for dredges, including grate bars, furnace dead plates, chain sheaves, gears, pinions, ratchets, etc.

At a meeting of the Board of Directors of the International Car Co., New Orleans, La., held on March 19, Seeley Dunn, Vice-President, was elected President, succeeding W. H. Bofinger, Sr., deceased. W. F. Bofinger, Jr., was elected Vice-President, succeeding Mr. Dunn. W. H. Bofinger, Jr., was elected a director to succeed W. H. Bofinger, Sr. The Vice-President will have jurisdiction over the purchasing department and will perform such other duties as are assigned to him by the President.

The J. G. Brill Co., Philadelphia, Pa., is building a new wood mill. Early this year there was a severe fire, and while it did not damage the wood-mill, the company is erecting a considerable extension to the present one in addition to the buildings which are going up to replace the ones which were burned. The work is being pushed as rapidly as possible, as the shops are now well filled with work and present orders will keep the plant busy at full capacity until the first of August.

Edward Rosing has been elected Secretary and Treasurer of the B. M. Osbun Co., Chicago. The Osbun company represent the Frick Co., makers of machinery; August Mietz, manufacturer of the Mietz & Weiss kerosene oil engines; Dayton Hydraulic Machinery Co., manufacturer of centrifugal pumps, and the Atmospheric Condensation Co., manufacturer of the Pennell flask-type steam condenser. The company is equipped with an able engineering department for laying out power plants, which is at the disposal of its customers.

The California Metallic Packing Co., Bee building, Sacramento, Cal., recently organized, has taken over the entire rights of the metallic packing known as the "K and Y" and "K and M" improved, sometimes called "The California Metallic Packing." This packing has been used by the Southern Pacific for a number of years on a large number of its locomotives. It is also adaptable for steam, water and air engines. The officers of the company are: President, Rufus Maker; Treasurer, John F. Fenton; Secretary and Office Manager, George R. Tuttle; Manager of Sales Department, H. S. Kozminsky.

The Ingoldsby Automatic Car Co., St. Louis, Mo., has for the last year and a half had about 400 Ingoldsby patent dump cars in service. Of this number 350 are used between Sunrise, Wyo., and Pueblo, Colo., for hauling iron ore. The average loadings of these cars has been 62½ net tons, and according to the report of the owners no repairs have been made on the equipment except in case of wreck. A feature of the Ingoldsby car is that it requires but one man to unload or to close and lock a car, the unloading being done in 10 seconds and the closing and locking in 40 seconds. The company has recently received orders for 104 new cars.

The Link-Belt Company, Philadelphia, Pa., reports the following as among orders recently received by the Philadelphia plant: Cuba—coal handling machinery for iron works, banana carrier, fueling barge equipment, automatic barrel elevator, mud conveyor. Florida—elevators, conveyors and miscellaneous machinery for handling phosphate rock, belt conveyor for lumber company. Massachusetts—coal handling machinery for large textile mill. New Jersey—coal conveyor. New York—freight carrier for paper mill, two bucket carriers for crushed coke, elevating and conveying machinery for refuse. Nova Scotia—coal handling machinery. Pennsylvania—coal elevator and conveyor, two chip handling conveyors, elevator for crushed stone, carhaul machinery. Virginia—elevators, conveyors and miscellaneous machinery for handling phosphate rock.

Among the orders recently booked by the Crocker-Wheeler Company, Ampere, N. J., are one for a 600-kw., 250-volt d.c. generator for William Rahr & Sons Co., Manitowoc, Wis.; another for a 500-kw. generator for the Shenango Furnace Co., Sharpsville, Pa. The Anderson Lumber Co., Passaic, N. J., has ordered a 125-kw. generator and switchboard and 160 h.p. of induction motors. These motors are all of the squirrel cage type. A 225-h.p. wound rotor type induction motor has been ordered by the Youngstown Sheet & Tube Co. for operating its wire mill at Struthers, O. The American Car & Foundry Co. has ordered a 100-h.p. shunt motor. The Pittsburg Steel Co., Monessen, Pa., has ordered two 75-h.p., 500-volt motors to drive drawn benches. The Newton Machine Tool Works, Philadelphia, Pa., has ordered a 22-h.p. adjustable speed motor with 1:2 speed ratio. An order for nine crane motors has been received from the King Bridge Co., Cleveland, Ohio.

The McKeen Motor Car Co., Omaha, Neb., shipped on March 19 two more of its standard 55-ft., 75-passenger, all-steel, 200-h.p. gasolene motor cars to California, where 15 cars of this design are in service on the branches of the Southern Pacific and private lines. The cars will make the trip to California coupled together and under their own power. This is the sixth shipment of McKeen motors cars to California in less than one year. Two were shipped to the Los Angeles & San Diego Beach last April; six to the Southern Pacific in August; three to the Southern Pacific in October; one to the Silver Peak Railroad in October; four to the Southern Pacific in February. All these cars made the trip on their own wheels and under their own power. The McKeen company now has 25 cars under construction, all of which are sold. Several have been chosen instead of electric cars for interurban lines on account of the great saving in initial investment, as well as the cheapness of operation. Five of the new 70-ft. cars, which seat 105 passengers, are also on order.

The business of the Western Electric Co., New York, in February ran at the rate of about $45,000,000 a year. Last month's sales were about 15 per cent. ahead of the sales in the corresponding month a year ago and the first quarter of the company's fiscal year, which ended February 28, 1909, ran about 30 per cent. ahead of the first quarter of 1908. A large part of the improvement continues to lie with the machinery department, though telephone business also shows a steady increase. As in January, a number of the Hawthorne shops are operating at full capacity and the electric light machinery shops are operating overtime. The most recent large order of importance was for two generators totaling 1,800 h.p. for the Albany shops of the New York Central & Hudson River. At present the company has somewhat over 16,000 employees. The use of the intercommunicating telephone in shops, factories and private residences is growing greatly. The increase in the number of the customers on the books during the first quarter was 40 per cent. The company is operating at about 70 per cent. of its capacity. The reduction in steel has had little effect upon the business. The policy of the Western Electric has been to maintain prices on its finished products.

TRADE PUBLICATIONS.

Air Receivers.—The Ingersoll-Rand Co., New York, in Form No. 9002, describe air receivers, pressure tanks and moisture traps.

Post Hole Digger.—The R. H. Vesey Manufacturing Co., Chicago, has issued a circular illustrating and describing the Ideal post hole digger.

Electric Train Lighting.—The University of Wisconsin has

just issued a bulletin entitled "Investigation of Methods of Railway Train Lighting."

Telephones.—The Western Electric Co., New York, is mailing a small booklet which describes new metal type intercommunicating telephone sets.

Paints.—A very attractive two-page folder recently issued by the Goheen Manufacturing Co., Canton, Ohio, calls attention to its carbonizing coating for iron and steel.

Signaling.—The Union Switch & Signal Co., Swissvale, Pa., has just issued bulletin No. 38 on the Union electro manual block system and bulletin No. 39 on the Union electric crossing gate.

Thermit.—The Goldschmidt Thermit Co., New York, has just issued a book of instructions for the use of thermit in railway shops. A number of half-tone and line illustrations show the use of thermit in locomotive frame welding.

Compressors, Excavating Machinery.—The Ingersoll-Rand Co., New York, in pamphlet 36-A illustrate and describe air compressors of various types and rock excavating machinery, including the "Sergeant," "Little Giant," "Electric-Air" and "Gordon" drills in pamphlet 47-A.

Creosoted Materials.—Wyckoff Pipe & Creosoting Co., Inc., New York, has just issued catalogue H, containing some interesting and valuable information on wood preservation, and the Wyckoff creosoted wood conduit, creosoted cross arms, poles, ties and bridge timbers, etc.

Switchstand.—Frank M. Foster, Columbus, Ohio, has just issued catalogue No. 1, which contains a detailed description of his type A interlocking switchstand. Four transparencies show the lever in the different positions. This switchstand was described in the *Railroad Age Gazette* of March 19.

Coaling Stations.—The Roberts & Schaefer Co., Chicago, recently mailed a number of sheets for insertion in loose-leaf bulletin No. 15, which is devoted to coaling stations, showing illustrations of a number of installations made by this company. Similar sheets will be sent out about once each year.

Blowers and Exhausters.—The American Blower Co., Detroit, Mich., is mailing a hand book of blowers and exhausters for forges and furnaces, which contains a large amount of valuable data on this subject, being useful to the prospective purchaser in selecting the proper size and type of equipment.

Hydraulic Jacks and Boiler Makers' Specialties.—A. L. Henderer's Sons, Wilmington, Del., have just issued a catalogue of hydraulic jacks and punches, tube expanders, pipe vices, screw punches and pumps. This catalogue is of the loose leaf variety, containing a large number of half-tone illustrations, price lists, etc.

Paint.—The Arkon Carbon Co., Chicago, is distributing a pamphlet describing its high grade carbon paint for the protection of metals. Accompanying the pamphlet are reports of tests made by two prominent engineers upon the qualities of Arkon Carbon metal protective paint, which show highly satisfactory results.

Railway Chemical Sprayer.—The Railway Chemical Sprayer Co., Owensboro, Ky., has issued a folder describing its method of killing weeds and all vegetation along railway track. A portion of the publication is a reprint from an article in the *Railroad Age Gazette*, which described fully the work done along 500 miles of the track of the Illinois Central.

Iron and Steel.—Joseph T. Ryerson & Son, Chicago, have just issued a handsome catalogue, which contains a full description, with half-tone illustrations, of their iron and steel warehouse and offices. The catalogue is printed on heavy glazed paper and contains some photographs which show various machines and general layout of the plant.

Portable Tools.—H. B. Underwood & Co., Philadelphia, Pa., have just issued a 1909 catalogue of portable tools for railway repair and machine shops. This catalogue contains descriptions and illustrations of a large number of portable tools, such as universal boring, turning and facing machines; portable pipe bending machines; crank pin turning and reboring machines, and locomotive pedestal leg facing machines. An added pamphlet describes rotary flue cleaners.

American Ingot Iron.—The American Rolling Mill Co., Middletown, Ohio, has issued literature giving the results of comparative corrosion tests of steel, charcoal iron and American ingot iron. The tests were made on samples of the same size and thickness immersed in 25 per cent. sulphuric acid for one and one-half hours. The loss to the steel sample is given as 90.7 per cent.; to the charcoal iron sample, 56.3 per cent., and to the American ingot iron, 1.55 per cent. Other pamphlets describe the corrugated metal culverts made of American ingot iron, metal roofing, conductor pipe, etc.

Valves.—The Nelson Valve Co., Chestnut Hill, Philadelphia, Pa., has just issued a new 1909 catalogue of Nelson valves. This catalogue contains 220 pages, printed on heavy paper and bound in heavy cloth board, being a very complete text book on this subject. The catalogue shows a large variety of gate, globe angle and check valves, of various metals. Among the new features included are the newly patented bronze swing check valves, hydraulically and electrically operated gate valves. Steel gate and globe valves for high pressures and superheated steam, and open hearth steel fittings are also included. The engravings show both interior and exterior views, and the descriptions, which in each case are printed on pages facing the illustrations, facilitate easy and critical study of each valve. Both test and working pressures are given, affording a definite basis for selection. This catalogue is one which should be in the hand of every man interested in the use of valves, and will be sent to any one making inquiry.

Water Softeners, Steel Tanks, Boilers and Structural Work.—"The Products of Kennicott" is the title of a large catalogue, 9¼ in. x 12½ in., just issued by the Kennicott Water Softener Co., Chicago Heights, Ill. The publication consists of a number of bulletins bound by brads through a perforated back, each being descriptive of one of the manufactured products. The first section is devoted to a history of the company and an illustrated description of the manufacturing plant at Chicago Heights. Water softeners are described in a 24-page section, including views of some of the notable installations. These include plants in nearly every civilized country and are used by various industrial enterprises, such as ice plants, tanneries and extract makers, water works, distilleries, etc. Several pages are devoted to the use of Kennicott softeners by leading railways and some figures give the results in the economy of fuel and the increased road service of locomotives. Description of the type "K" softener, with accompanying photograph cut away to show the sectional construction, is given in concise detail. Bulletin No. 31 describes the operation of the type "A" water softener. Bulletin No. 32 describes the operation of type "B" softener. A 10-page bulletin is devoted to the Bonus-Kennicott water tube boilers. Steel water tanks and car tanks are fully described in a 16-page section. A partial list of the users of Kennicott water softening machines covers a four-page insert and includes industrial companies making various things and a large number of railways. Any section or a complete catalogue will be sent by the company upon request.

A Modern Blueprint Plant.

An interesting exhibit at the Chicago Coliseum during the Maintenance of Way convention was a blueprint plant in operation, exhibited by the C. F. Pease Blue Print Machinery & Supply Co., Chicago. This consisted of automatic equipment for producing blueprints by one continuous operation. The apparatus occupies a space about 5½ ft. x 8 ft. and with it one man can easily print, wash and dry a 50-yd. roll of blueprint paper per hour. The outfit is claimed to be especially efficient where large quantities of blueprints are required in the shortest possible time, although the makers claim great economy by this process to any one using 30 or more 50-yd. rolls of blueprint paper per month.

The operation of this apparatus is so quick that within 10 minutes from the time the tracing enters the printer the finished print, washed, potashed and dried, is delivered in the automatic rerolling device at the back of the machine ready to cut off. While with the ordinary blueprint process the job is only fairly begun when the exposure has been made, by the Pease process the prints are thoroughly washed and dried ready for use in practically the same time that it takes to print them, making a very large saving in labor. By this continuous process of washing and drying the shrinkage is reduced to a minimum and, in fact, with some grades of paper it can be entirely eliminated. This

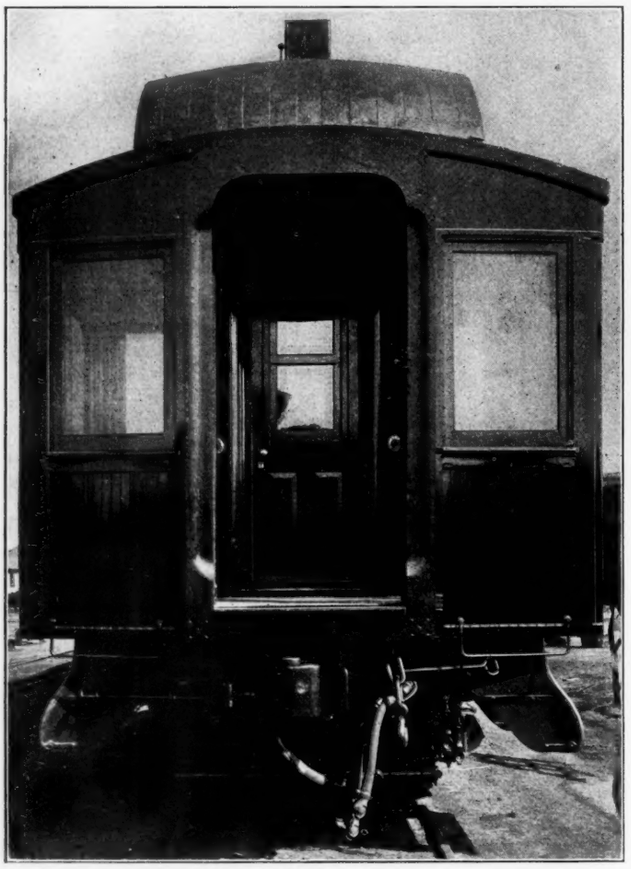
is due to the fact that the paper is only wet on the treated side and passes over the dryer before it has a chance to become water-soaked.

With this same apparatus, by the addition of the Pease developer and the use of specially sensitized paper, a very fine quality of blue line prints can be made direct from the tracing without a negative, as fast as blueprints are made. These blue line prints—known as Pease direct white prints—are made on a very high grade of paper, giving them great strength and excellent wearing qualities. Absolute permanence is claimed for them, the strongest sunlight having no effect upon them, and there is practically no shrinkage. This work is especially valuable for profiles and progress charts and is being used to good advantage by auditing departments for tabulation work, which can be produced direct from typewritten copy on a special transparent paper.

A cutting and trimming table shown with this machine is also unique and should be of value in any blueprinting room. The cutting and trimming device at the end of the table is provided with a parallel clamp worked with a foot treadle which holds the paper or print securely while the revolving cutting knife, rotated positively by mechanical means not dependent upon friction against blade or paper, is used. This device trims paper very accurately and rapidly. This company also has other printing apparatus for use in smaller plants.

Labadie Vestibule Diaphragm Face Plate.

While cars are in motion, the slack running in and out at frequent intervals creates an aperture between the vestibule face plates, and on rough track or short curves the passenger, without realizing his danger, may grasp the inner edge of the face plate with thumb and fingers and



Coach Fitted with Labadie Plate.

frequently the fingers are crushed. The device here illustrated is intended to prevent such accidents. The improved face plate has a rabbetted edge or recess extending from within 6 in. of the platform to the curvature at the top of the face plate, the recess having a depth toward the outer edge of 4 in., the balance of the width, 1½ in., being left for dust and water closure. Each recess or rabbetted part has a depth of 1 in., making a space of 2 in. in which the passenger may place his fingers with safety. The object of this recess device is not only to save railway payments for personal injuries, but also to save the curtain devices. When the vestibule traps are closed and the trainmen cannot get within the vestibule to unhook the curtains and the cars are separated, the curtains are pulled apart until they break and are thus rendered inoperative.

The old face plates are utilized by being removed from the car, heated red hot so as to permit of being shaped by a bulldozer, and pressed between the formers which create the recess or rabbetted edge. By manufacturing a number at a time the cost is materially reduced. The expense of converting the old irons into the new device averages $3.50 per car. The process does not reduce the width of the original

Labadie Recessed Face Plate.

face plate, as the great pressure applied when creating the recess is sufficient to expand the metal enough to take care of the angle of the recess.

This device has been adopted by the Texas & Pacific and other southern roads. The illustrations show the improved diaphragm as applied to the car and a detail of the diaphragm. This device is patented by Victor Labadie, who is connected with the Texas & Pacific Ry. Address 181 Live Oak street, Dallas, Texas.

Keuffel & Esser Convention Exhibit.

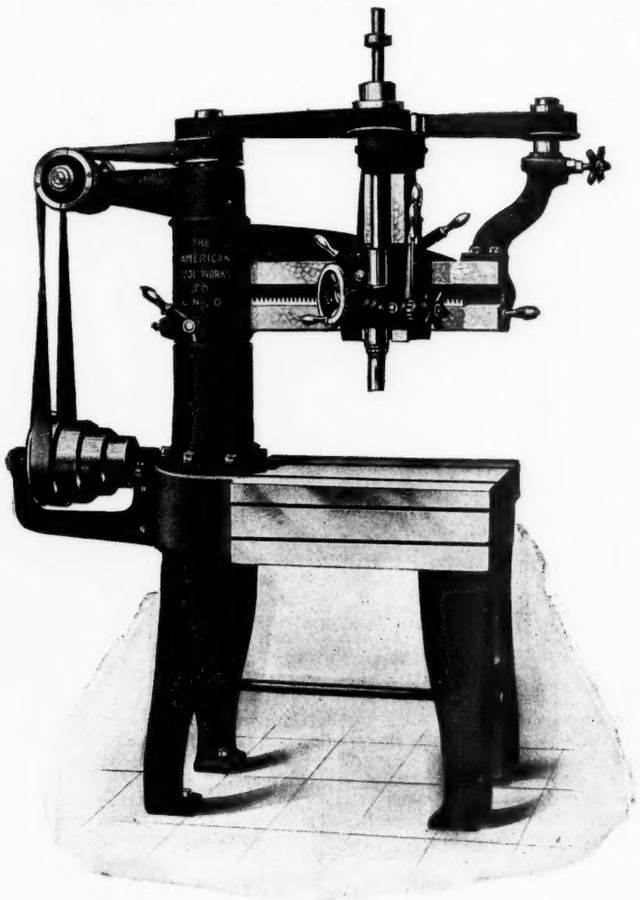
An attractive exhibit of surveying instruments, leveling rods, ranging poles, steel and metallic tapes, slide rules and a general line of mathematical instruments was made at the maintenance of way convention in Chicago by the Keuffel & Esser Co., New York, through its Chicago house. The surveying instruments were of the latest pattern and a good many of them had never before been shown in this country. Attention was especially directed to the new extra-fine engineer's city transit, mountain and mining tachymeter, triangulation instruments, municipal triangulation theodolite and the Wisconsin transit, on which neither time nor labor has been spared to meet the wants of engineers. This concern has had for several years a lens-grinding department and therefore can furnish the highest grade of lenses.

The measuring tapes exhibited had the new "Keco" finish, which produces a dense, even black tape line with brilliant bright-steel graduations and figures. This finish is claimed to wear well, guard against rusting and obviate the necessity of greasing the line to protect it. The slide rules shown had special adjustments to prevent the slide becoming too loose or too tight.

American High Speed Sensitive Radial Drill.

The high speed sensitive radial drill shown in the accompanying cut, is designed to combine the efficiency of the sensitive drill with the convenience and high productive capacity of the radial, and with the idea of simplifying all the operations of the machine. The levers are placed in a convenient position and movement of the head and arm is such as to facilitate rapid manipulation. The work to be drilled is placed upon the table and does not have to be reset for each individual hole.

There are no gears in the driving mechanism from the countershaft through to the main spindle, it being driven by a 2-in. double belt running at high speed, transmitting power direct to the spindle. The spindle belt is kept at proper tension by adjustment of the star knob seen in the illustration. All the driving and idler pulleys are equipped with special ball bearings, consisting of a double set of hardened and ground ball races and cones, one set being located at each end of the pulley journals. They are designed to be dust proof and to form a retainer for the lubricant. The spindle is of high carbon crucible steel, accurately ground and provided with dust proof self-lubricating



American High Speed Sensitive Radial Drill.

ball thrust bearings. There are six changes of speed, ranging from 300 to 900 r. p. m. in geometrical progression, obtainable through a two-speed countershaft and three-step cone pulley. An adjustable stop collar is provided at the top of the spindle, which collar may be used as a depth gage. The spindle is fed by a long hand lever on a ratchet wheel, the latch handle being self-releasing when in the uppermost position. A convenient star wheel provides for quick return of the spindle.

The column is of tubular section, heavily ribbed internally, and of sufficient stiffness to withstand all strains. It extends through the arm into the cap at the top of the drill and is firmly bolted to the top of the table. The arm is of parabolic beam and tube section design. The lower line side of the arm is parallel to the table, thus enabling the full capacity of the drill to be used at any point along the arm. The arm swings easily on the column and may be clamped in any position by a convenient binder lever. This arm has no movement vertically, since provision is made on the head for variable heights of work.

The head is of special design and may be moved rapidly along the arm by a hand wheel through angular rack and spiral pinion, and clamped at any point along the arm by the hand lever shown at the right of the head. The head consists of the main saddle which slides upon the arm and carries an auxiliary sliding head on a vertical dovetail. This allows a vertical movement of the head and makes elevating and lowering of the arm unnecessary. The vertical slide may be securely locked by a lever shown at the left of the head. Provision is made for taking up any wear of all slides.

The table is accurately planned and is of full box construction, heavily ribbed and mounted upon substantial legs, forming a rigid and convenient arrangement. The top and front slides are fitted with T-slots, planed from the solid, and the back end is planed for use in squaring up work. The two-speed countershaft is of special design for high speed work. The boxes in the hangers are of improved gravity and wick oiling type, obtaining oil supply from large reservoirs, and attention is necessary only at long intervals. The countershaft carries a three-step cone pulley, with a pair of friction pulleys, 10 in. in diameter by 3 in. face; and should run 310 and 387 r.p.m.

These machines are made with 2-ft. and 3-ft. arms and the following tabulation shows some of the principal dimensions:

	2-ft. Arm.	3-ft. Arm.
Spindle speeds, r.p.m.	300 to 900	300 to 900
Drills to center of circle outside of column	49 in.	73 in.
Minimum dist. from spindle center to column	6¼ in.	6¼ in.
Max'm distance from spindle to table	19 in.	19 in.
Height of table above floor	35 in.	35 in.
Working surface of table top	20 x 28½ in.	20 x 40½ in.
Working surface of table side	6¼ x 28½ in.	6¼ x 40½ in.
Max'm height to highest point of spindle	7 ft. 7½ in.	7 ft. 7½ in.
Traverse of spindle at one setting	5½ in.	5½ in.
Vertical traverse of head slide	8 in.	8 in.
Traverse of head on arm	18¼ in.	30¼ in.
Dist. from underside of head to table	15¾ in.	15¾ in.
Width of drive belt on machine	2 in.	2 in.
Width of drive belt on countershaft	2½ in.	2½ in.
Floor space (full swing)	66¾ x 87½ in.	78¾ x 111¾ in.
Speed of countershaft (2-speed) r.p.m.	310 and 387	310 and 387

The manufacturers claim that under ordinary conditions, the 2-ft. arm machine accomplished the following drilling in cast iron: ¾-in. drill, 375 r.p.m., 73-7 ft. cutting speed, 0.028 in. per minute, at rate of 10½ in. per minute and consuming 3¼ h.p. at the drill. This machine may be equipped with a tapping attachment.

The American Tool Works Co., Cincinnati, Ohio, makes these tools.

The "Normal Danger" Patent.

In affirming, on March 16, 1909, the decree in favor of the Hall Signal Co., sustaining the validity of U. S. patent No. 470,813 granted to A. J. Wilson, March 15, 1892, the opinion of the United States Circuit Court of Appeals at New York was handed down by Judge Coxe. It contains the following passages:

The patent relates to the so-called normal danger system as distinguished from the normal safety system, it being contended that the patentee was the first to make the former a safe, reliable, simple and workable system—having marked advantages over the systems of the prior art. * * *

Under the normal safety system, when the engine driver approaches a block the semaphore at the entrance is in an inclined position by day and shows a green light by night indicating that the track ahead is clear, and that he may safely proceed unless the signal rises to a horizontal position, or shows a red light. In other words he is to assume that the track ahead is clear and safe until the contrary appears by the appearance of a danger signal.

The normal danger system, on the contrary, always shows a red light at night and a horizontal semaphore by day, indicating danger; the safety signal appearing only on the approach of a train and when the block to be protected is clear. In the first system the assumption is that all is safe ahead till "danger" appears, and, in the second, that all is unsafe ahead until "safety" appears.

In the one, if there be no movement of the signals, the engine driver keeps on, in the other, unless there be movement of the signals, he stops. To quote from the pamphlet said to have been written by the president of the defendant: "Consistency argues that all the signals shall indicate danger, except where they are cleared for the passage of a train."

From the viewpoint of safety it seems to us that the preponderance of evidence is clearly in favor of the complainant's system. If, through climatic or other influences, the signals cease to operate, it seems obvious that it is much safer that they should clog in the danger rather than in the safety position. In the one case the failure of the signal to operate might result in the unnecessary stopping of the train; in the other it might result in a rear-end collision. It is not at all improbable that laymen may give greater weight to this feature of the system than practical railway men, but it seems to us that an improvement which reduces, in any degree, the chances of derailment and collision, and thus safeguards life and property, is entitled to greater consideration than one which deals only with economics.

We do not intend to intimate that the Wilson system does not,

from a practical point of view, compare favorably with the normal safety plan; quite the contrary appears. As the electric current is in operation during the comparatively short time that the signal stands at clear, it is obvious that there is very much less consumption of battery material. As one of the witnesses points out, the expense of maintenance increases only in proportion to the amount of use, whereas in the normally clear system the expense is greatest when apparatus is least used.

Scientific men, versed in the art of railway signaling, had early recognized that the logic of the situation was all with the normal danger theory. Thus, in 1842, Sir William Cooke writes, "I think it highly desirable that the ordinary or quiescent condition of the station signal should be a state of danger, and not a state of safety, so that a train should never run into a station without special guarantee that it was prepared to receive it." This was before the days of automatically controlled block signaling, but it shows that early in the art of railroading it was recognized that the ideal position of the signal was one indicating normal danger.

The difficulty was not with the theory but with the means to make the theory practicable. This was an easy task when applied to a manually operated system, but the record shows that its practical application to an automatic system was obstructed by impediments which it was found impossible wholly to remove, although many skilful and scientific men were at work on the problem.

At the date of Wilson's invention, in 1891, the art of railway signaling was in an embryonic condition. Men of genius and skill, cognizant of the advantages of the normal danger plan, were endeavoring to produce a practical system, but none, prior to Wilson, succeeded in perfecting a plan to which hard headed railway men were willing to intrust the lives and property committed to their care.

The defendants rely upon patents granted to five inventions—Robinson, Spang, Pope, Gassett and Westinghouse—to defeat or fatally limit the claim in suit. William Robinson, in 1872, received a patent, relating to a normal safety system and in 1879 he received a British patent for a normal danger system. It is not pretended that either of these patents anticipates, but, if we comprehend the defendant's contention, it is that Robinson possessed the knowledge, as demonstrated by the description and drawings of his patents, to convert the plan of the earlier patent into a successful normal danger system.

A sufficient answer is that patents are not defeated by what prior inventors might have done. They, like other men, must be known by their works, and no one pretends that the plan described by Robinson in the British patent 3479, in 1879, was operative. At least, no one ever attempted to operate it. No reliable protection is shown and it is doubtful whether it could be operated in connection with a block system.

Robinson is conceded by all to have been one of the most accomplished signal engineers of his time. The fact that he failed to convert his 1872 system into a normal danger system is mute but persuasive testimony that it was not an obvious thing to do.

* * *

Four patents, Nos. 164,227, 164,228, 168,059 and 208,995 were issued to Henry W. Spang, from 1874 to 1878, describing with great particularity eight normal danger plans which never went into use. Being radically wrong in theory, they could never be made practically useful. The initial errors in Spang's system were insufficient length of the clearing section and lack of efficient protection for the train while on that section. The defendant's counsel deny this, but we are not convinced by their argument. We agree with the judge of the circuit court in holding that the protection afforded by the Spang patent, 164,227, was insufficient "owing to the magnetization of a magnet which in this type of signaling was necessary in order to hold the signal in its danger position." * * *

Frank L. Pope in 1873 was granted a patent, No. 143,529, covering a normal danger system or, more accurately, two such systems. Here too we have the fatal defect of clearing sections, but 50 feet in length and wholly unprotected. The plan was never put into actual use and is admitted to be wrong in principle.

Oscar Gassett, in 1882, was granted a patent, No. 251,867, for a normal danger system, which like all the others which preceded it, was never a practical success. * * * It is enough that a patent which was respected by competitors for 13 years and which covers a system which has been in successful operation during its entire life cannot be invalidated by the ambiguous language of a patent which has added nothing of value to the art. * * *

When Wilson took up the work it had virtually been abandoned by the others; they had tried and failed and there was no reliable normal danger plan then in existence. That Wilson solved the problem we have no doubt; the systems installed under his patent are successful and are rapidly growing in popularity. We do not consider him a pioneer in the sense that he discovered a new art. The idea of a normal danger system was old, but he was the first to harness it and set it to work. So much he has contributed and to this extent he is entitled to protection.

In approaching the question of infringement, it must be remembered that the controversy is confined to the first claim which covers the broad invention and has no connection with the second claim which relates to the specific means described and diagrammatically shown. Having found that Wilson was the first to devise a successful normal danger system affording full protection to the train in front and rear for every inch of track, it is manifest that a construction should be placed upon the claim as broad as the invention and that he who uses the invention without license should be held to infringe no matter what else he may use.

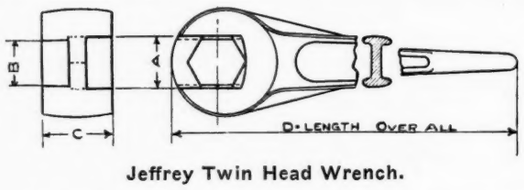
Jeffrey Lock Jaw Track Wrenches.

The Jeffrey Manufacturing Co., Columbus, Ohio, has introduced, through its forge and foundries department, a new design of railway track wrench which is a practical and economical tool. It is a simple and practical development to meet the demand for a wrench, the jaws of which will not spread. Those familiar with the severe service of track work will appreciate a tool which will meet this demand. The designs shown herewith are the first of a variety of designs in which the wrench will be made to provide for practically every different kind of service for which the open end wrench is used. The wrench is a combination reinforced spanner and box wrench, and the accompanying illustrations show this feature and the manner in which the web binds the jaws together to prevent spreading. This web not only prevents spreading, but also allows the insertion

Jeffrey Lock Jaw Track Wrenches.

of a hexagon box wrench opening, in addition to the open end spanner on the opposite face. The web opening may be of the same or different size from the spanner opening. The wrenches shown in the accompanying half-tones are furnished in two kinds of finish, either unhardened or with fail case hardening. Each wrench is sold with a guarantee of replacement of any wrench which fails in track service through spreading of its jaws.

A twin head wrench, shown in the accompanying line cut, is also made by this company. It is designed especially for use in track work on a line using different size of bolts. A solid web extends



Jeffrey Twin Head Wrench.

between the two openings, making a very substantial construction. This twin head wrench will take three different sizes of nuts, two in the spanner openings and a third in the web opening. This form is especially useful on a stretch of track where the main line uses ⅞-in. or 1-in. bolts and the sidings, of lighter steel, ¾-in. and ⅞-in. bolts.

The Jeffrey Manufacturing Co. also makes a multi-claw bar, which has also been designed to meet the demand for economy in track tool maintenance. In case of a claw breaking, it is simply necessary to remove the bolt and reverse the claw. The bar and head of this device are forged from high grade selected steel, and the jaws of tool steel, oil tempered, to give the necessary strength and toughness.